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OF

SCIENCE AND ARTS.

CONDUCTED BY

BENJAMIN SILLIMAN, M. D. LL. D.

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☞ Some memoranda of errata, having been mislaid, are necessarily omitted.

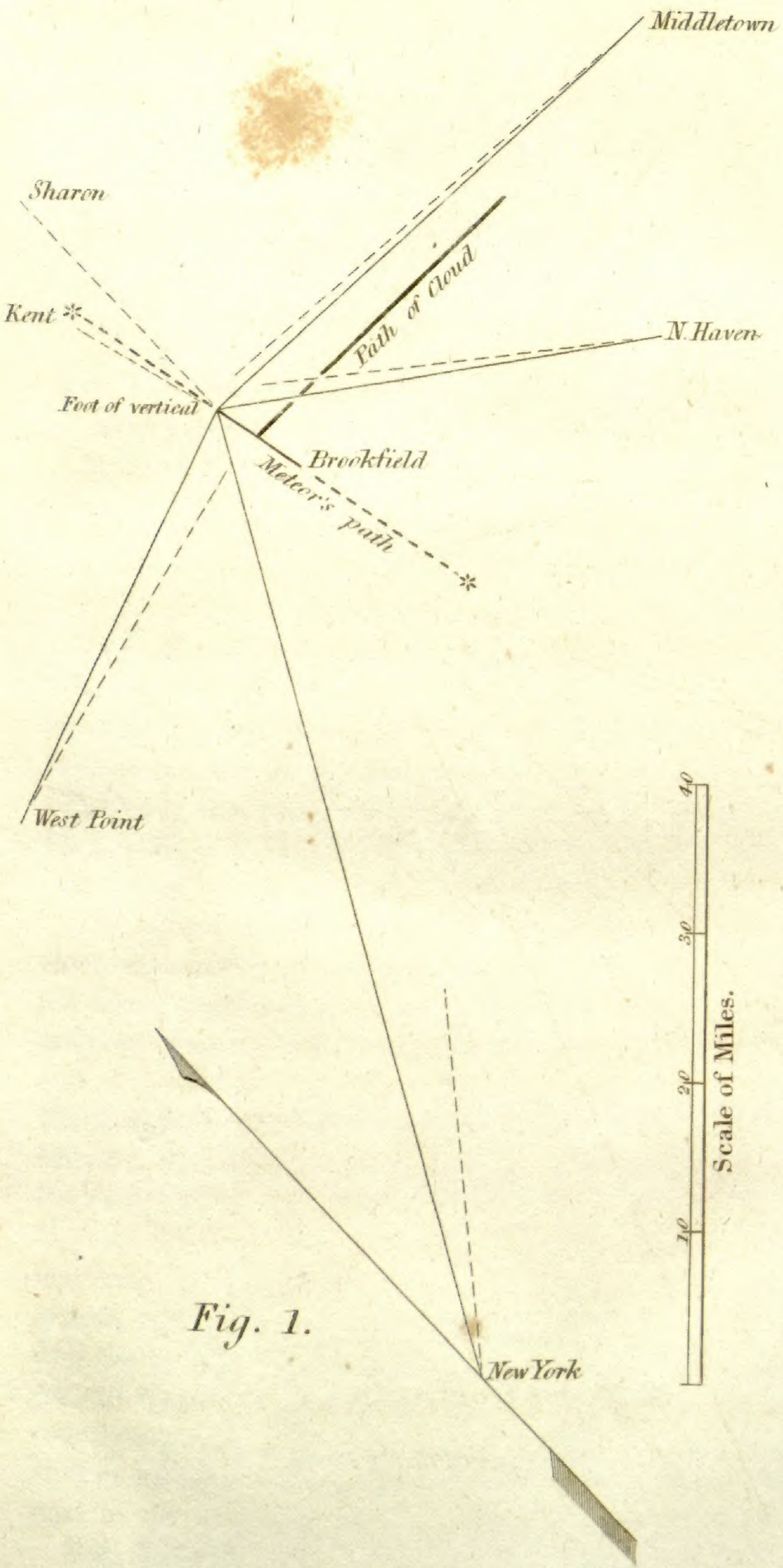

Fig. 1.

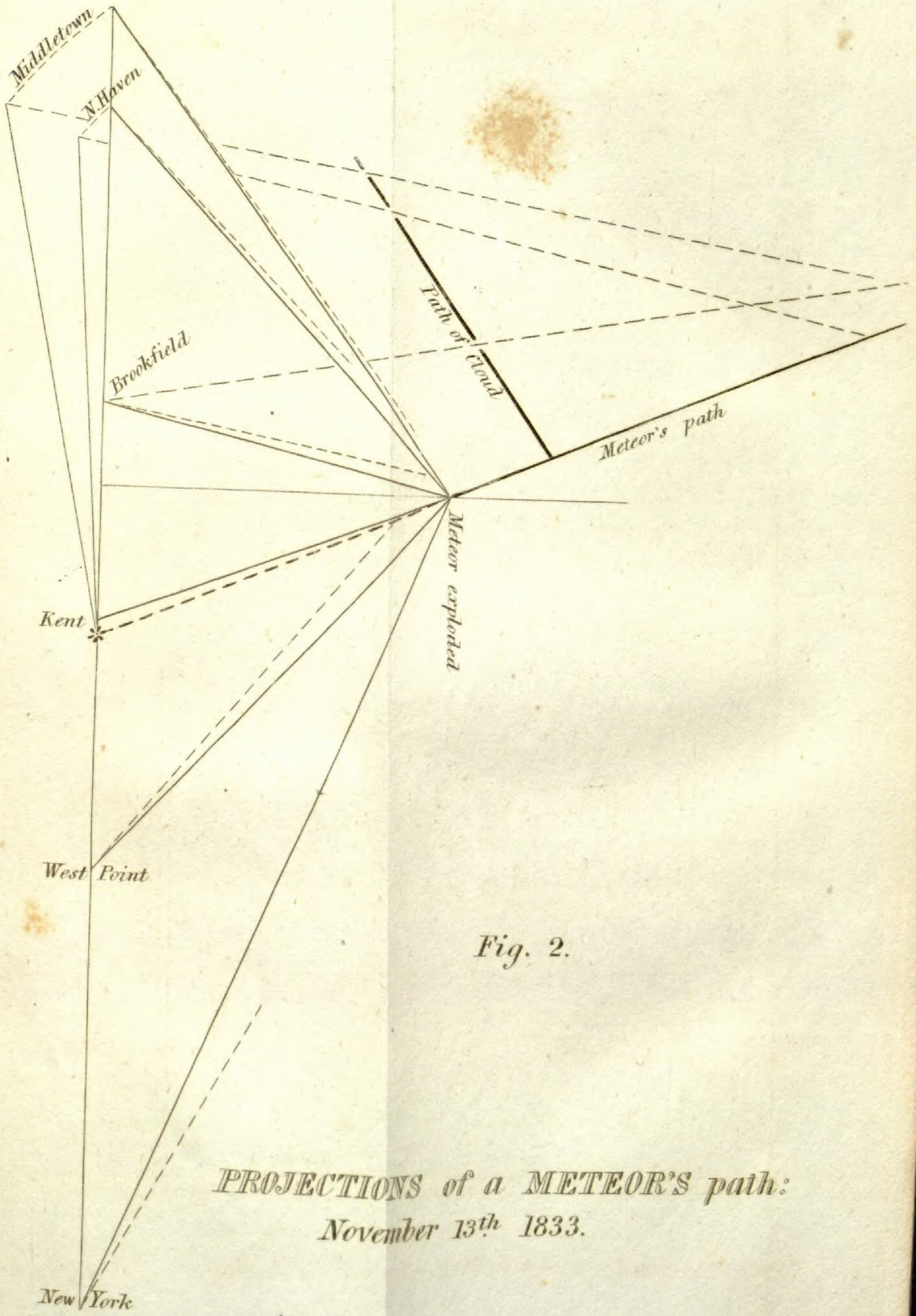

Fig. 2.

PROJECTIONS of a METEOR'S path:
November 13th 1833.

THE

AMERICAN

JOURNAL OF SCIENCE, &c.

ART. I.—*Remarks upon the Geology, and physical features of the country west of the Rocky Mountains, with Miscellaneous facts; by* JOHN BALL, of Troy, N. Y.

I. GEOLOGY AND GEOGRAPHY.

Troy, November 27, 1834.

TO PROFESSOR SILLIMAN.

Dear Sir,—THE article, communicated by Prof. Eaton, and published in Vol. XXV, No. 2, of your Journal, as being founded on a letter he received from me, written on the Columbia river, is found, in some respects to demand correction; to do which, (in the mean time taking the liberty of stating a few facts, observed during the journey across the continent and a residence in that country,) is the inducement to make this communication.

The route pursued was from Lexington in the State of Missouri, along the road of the Santa Fé traders, about thirty miles beyond the line of that State, thence N. W. to the Kanzas river at the government agency, up that river to the village of the Kanzas Indians, then across the country, encamping on the Blue Creek, to the river Platte against the Grand Island. Soon after leaving the State of Missouri, the country becomes comparatively barren, with little timber except along the streams, and the grass not of sufficient growth to carry fire over the undulating prairies. Sandstone and flinty limestone, both containing many shells were found in *place*, and granite, and red quartzose rock in *bowlders*. Ascending the Platte, over the bottoms of two or three miles in width, to its Forks, you pass no streams coming in from the sandy bluffs, and rolling barren country beyond. The river is very broad and shallow, unfit for any kind of navigation, and sweeps along its due proportion of sand and mud to the main Missouri. At the forks of the Platte were met

the first buffaloes ; in fact no animals deserving of notice had been seen before, for all appear to have been destroyed by the hunters, or to have fled from their pursuit. From this time buffalo meat was the principal, or rather only article of food, and much of the time it was eaten even without salt. Still from that cause little inconvenience was experienced.

Do carnivorous animals seek licks and salt springs, or herbivorous animals only, and would man live on vegetable food without that condiment, and not suffer in his health ? It was now the first of June, and to this time there had been frequent rains, thunder showers coming from the N. E. and the thermometer ranging at noon from 50° to 80°.

Now crossing the South to the North branch of the Platte, our journey was continued up the south side of that river in a W. N. W. direction about three hundred miles, over a country, for the first two hundred miles, similar, in most respects, to that on the main river below. The river was shallow, rapid and muddy ; it was about one mile wide with extensive bottoms on one or both sides, which were in many places, incrusted with salt, a mixture of muriate and sulphate of soda ; prickly pears, (cactus) and a kind of shrub, called wild sage, were found very extensively over the prairies. The bluffs in our rear were of sandstone, often worn into the form of domes and columns, and the country back afforded so little water that the river rather increased than diminished in size, as we ascended towards the mountains. Thermometer from 75° to 80° at noon. For days, hardly a tree was to be seen, even along the river, but on the Black Hills, which we now reached, stretching at right angles to the course of the river across the country, a few stinted cedars were observed, from the dark appearance of which, probably proceeds the name of these heights. Here the country, for two or three days travelling becomes quite broken, affording refreshing streams and green herbage.

The rock is gray puddingstone, and red sandstone in strata, rising a little towards the west. Then the country becomes open on the north of the river, but mountains appear on the south, and probably continue on in that direction, till they join the Rocky Mountains at the place where they were seen by Major Long. Snow was seen in the higher parts of these mountains, at this time, being the middle of June.

The river tending S. W. we soon crossed it, and continued our journey about west, most of the time along a branch of the Platte,

called the Sweetwater. On each side of this river, from a horizontal plain of sand and sandstone, rise ridges of naked granite rock, capped with snow, and to the west could be seen the Wind-river mountain towering high, as white as winter could make it. After continuing on over a country, first of sandstone then of mica slate, with very little timber, we arrived at the head waters of the Sweetwater, about one hundred miles from the place where we had fallen on to that branch, or four hundred from the Forks of the main Platte.

Two hours ride over a smooth prairie, and slight swell, now brought us on to water flowing into the Pacific Ocean; not however, as our Geographers would lead one to expect, upon the waters of the Columbia, but those of the Colorado, of the gulph of California.

In fact, after leaving the main Platte, there is, as far as it has fallen under my observation, no further reliance to be placed upon maps or accounts of the country. The Arkansaw and Lewis river, instead of rising together as has been represented, have not their sources within five hundred miles of each other, the waters from an extensive region flowing south into the Gulph of California.

Standing on the *dividing* ridge between the great Oceans, at an elevation, (judging from the temperature of boiling water,) of about ten thousand feet, you look down East upon the granite mountains already passed, and then to the N. W. upon the snowy Wind-river mountain, rising probably, five thousand feet above the place where you stand. To the South on the height of land, stretches an immense prairie, as far as the limits of vision, with little variation of surfaces, on which are feeding herds of buffaloes; and far to the West, extends north and south, a range of mountains of apparently great elevation. Our journey now lay, for about one hundred miles, in a N. W. direction, along the foot of the Wind-river mountain, across torrents flowing cold from the same, and at about the same elevation; the travelling is sometimes almost obstructed by the granite bowlders, which showed conclusively the character of that mountain. On this mountain are said to rise the Wind-river and other branches of the Yellow Stone, the Missouri, Lewis river and Colorado. It was now the first of July, and we occasionally met with drifts of snow, and frequently had frost at night, although at noon the thermometer ranged from 60° to 70°; the nights were always clear, and the days were, generally, so too, although sometimes attended by slight squalls of rain, snow or hail. In one of the snow squalls, on the 4th of July, we reached

a brook flowing into the Lewis river, which we pursued through a deep break in the mountains, observed some days before in the west. These were found to consist of sparry limestone, and sandstone. Continuing our journey still in a N. W. direction through a broken country, across a larger branch of the Lewis river, and over a mountain of rock similar to the one last mentioned, we came to a plain, open only to the north and surrounded by snowy mountains. The rounded stones and gravel observed here, were all compact gray sandstone. At this place, where we remained some days, we observed that thunder showers come uniformly from the S. W. and not from the W. and N. W. as on the Atlantic.

The last of July we left this place, travelled S. and recrossed the mountain and Lewis river, the country to a great extent being much broken. We met with limestone of different kinds, and with sandstone.

We saw, also, for the first time, nigh the river, at probably one hundred miles from its source, resting on pudding stone, *a stratum of dark porous rock, evidently of volcanic origin.*

Leaving the river and going S. W. over a mountain of sandstone and sparry limestone, arranged in strata, highly inclined to the horizon, we encamped on a creek with high bluffs, composed entirely of volcanic rock, of from fifty to a hundred feet in height, a truly novel and interesting sight! The rock in particular parts, presented somewhat regular columns with small pores, and then irregular masses, with pores often of a size to contain many gallons, the whole having a dark burnt aspect, the upper parts presenting a somewhat stratified appearance. The next day we travelled in the same direction over a high barren plain, *strewed with volcanic glass and sharp broken stones of similar origin*, having little other variety in its surface than the deep channels of the streams.

We continued our journey, for many days, in a leisurely manner, and by a zigzag route, but the general course tended S. W. for a direct distance of about four hundred miles, over ridges, and crossing streams falling into the Lewis River from the S. E.

The atmosphere was still extremely dry, as was indicated by the shrinkage of timber and by extreme thirst. Occasionally, a threatning cloud of small size was formed, attended by thunder, when the rain might be seen falling part of the way to the earth, but seldom did a drop reach its thirsty surface. The plains, along the creeks, were of volcanic rocks, similar to those before described, and most of

the intervening mountain ridges were composed of the same limestone that has already been named; but in one instance, we met with a mountain of mica slate and variegated marble, unburnt, while bowlders of the same were strewed over the basaltic plains. In another place we saw a country, broken into granite peaks, which appeared to have undergone the action of fire in different degrees. In some parts, the rocks were crumbling into sand, in other places they were vitrified, so that the particles of quartz appeared like glass; again, the whole appeared to have been melted so far as to form an impure jasper, and again it was transformed into amygdaloid. Often in the streams and elsewhere, we found chalcedony and other silicious minerals, apparently of the same origin.

Against the American falls, we were in sight of the Lewis river, beyond which extended an immense open plain, with a snowy mountain beyond. There was also snow on some of the mountains about us and often frost at night, it being now August; still the temperature at noon was from 70° to 80°. It was said, we passed nigh a large salt lake on the left, into which, flow several fresh rivers, and from which there is no outlet to the ocean, as laid down in maps. And why need we suppose an outlet, since we know that similar lakes, are similarly situated in the center of other continents? And did such an outlet exist would it probably continue salt? The supply of aqueous vapor to the atmosphere, in situations remote from the ocean, appears insufficient for the promotion of vegetation, and thus are producing desert steppes and savannahs, and our own parched prairies of this central region.

The last of August we had reached a country open to the south, with the streams flowing that way, and which do not probably join the Columbia. Here twelve of us, neither of whom had before been west of the Alleganies, bade farewell to our trapping companions, with whom we had travelled for mutual protection, from the Blackfoot Indians, whom we had now passed, but gained nothing on our journey as to the distance, to be travelled.

We now turned our course N. W. and set ourselves to seek our way as it were, by *instinct*. We soon reached the head waters of a creek, by pursuing which in a N. W. direction, about one hundred miles, we again fell in with the Lewis river. The first part of the way was through a broken country, of granite, mica slate, clay slate, marble, sparry limestone, (burnt and unburnt,) then over a plain of apparently burnt sandstone, broken only by the creeks,

which flow, as it were through clefts, produced by the baking and shrinkage of those plains, at a depth of many hundred feet below their surface.

There are but few places where from the parched plain, on which little water is found, you can descend to the streams below; these places are marked by Indian trails. The stream being once gained, you look up and behold perpendicular bluffs of one hundred feet in height, then by offsets asscending still higher, composed of strata still showing in some places the appearance of grey and red sandstone, in others, strata partly melted down, and presenting the appearance of lava. On one part of this creek gushed out in great numbers, from the porous bluffs, *springs and small creeks of water, apparently pure, at the temperature of* 100°.

We here found the Lewis river, a beautiful stream abounding with salmon, now the main article of food, for long since, we had passed the range of the Buffaloes, which are never seen at a great distance this side of the mountains. Here, and in other places further down the river, were columns of basalt thirty feet high resting on sand, which seemed constantly undermining the rock, and precipitating it far below. The basaltic bluffs sometimes approach the river, and again recede, leaving fine bottoms, over which we travelled in a N. W. course, crossing some creeks coming from the S. W. Thus we continued our journey, passing slowly along, so as to permit our foot-sore horses to recruit. On the last of Sept., we came to the place where the river turns to the north and enters a mountainous country, which shuts it in, in a manner completely to obstruct travelling nigh its banks, but we found an Indian trail leading up a creek, which takes first a west and then a north west direction, through a very mountainous country, which mountains are composed principally of burnt rocks, presenting occasionally however, bowlders of granite and other primitive rocks.

After some days, we came into an oval plain crossed by some creeks; the plain was fifteen miles in diameter, of great fertility and apparently surrounded and enclosed by high mountains. On leaving this plain, our course still continuing north westerly; we ascended a high mountain and travelled along a ridge of the same on an Indian trail, when the whole country to the south and west presented similar ridges, partially clothed with fine timber. These are called the Blue mountains, and are also porous rock. Far in the west could be discerned a conical snowy mountain which proved to be Mount

Hood. Two days of severe travelling, with only water at night, and some rose and thorn berries for food, brought us down on to a prairie extending without apparent limit before us. After travelling on this two more days, without even berries, being somewhat dubious as to the proper route on account of the crossing Indian paths, we met with some natives from whom we obtained food. The day following, we reached Fort Wallawalla, which is situated at the mouth of a creek of the same name, nine miles below the mouth of Lewis river.

We had now reached *Terra cognita*, a place inhabited by some half a dozen white men. Here we parted from our faithful horses, some of which had accompanied us from Missouri, while others were purchased of Indians, who possess them in great numbers; we next hired a boat and guide, and embarked on the Columbia. On this part of the river, and for a long distance below, there is only drift timber, the country being sandy and gravelly, and as you descend, there may be seen on one, often on both shores, the "*High black rocks*," mentioned by Lewis and Clarke, presenting pentagonal columns of from one to five or six feet in diameter, composed of blocks of a slightly concave form, set into each other, till they are raised to a great height.

At the Great Falls commences scattering timber, which at the Cascades, the last rapids before you reach tide water, becomes a dense forest, although there are extensive prairies, still lower down. Here the country is crossed by another range of mountains similar to the Blue mountains, crossed before reaching Wallawalla, and here resting on pudding stone. We now experienced the first rain, in any quantity, since we left the Forks of the Platte, five months before. Descending the river about forty miles, through a low country, we reach Fort Vancouver, the principal depôt of the Hudson Bay Co., the west side of the mountains, situated on the north side of the river, one hundred miles from the ocean and six above the mouth of the Wallamette. The country, for many miles about Vancouver, is uninterrupted by mountains, and is mostly wooded. Still, there are many extensive prairies of great fertility, especially along nigh the river. Some of these however, are subject to be flooded by the freshets which occur in June, when the river rises to a great height.

As you descend the river to within forty miles of the ocean, you again meet mountains similar to those at the cascades, in places un-

derlaid by very friable sandstone, and clothed with a very heavy growth of timber.

The Wallamette, (Multnomah,) is of much less extent than has been supposed, not being more than two hundred miles in length. Along its spreading branches above its falls, to which the tide flows, about twenty miles from its mouth, extends a very beautiful valley, of interspersed prairie and woodland. West of this valley, are the mountains extending along the coast, and on the east the range stretches south from the cascades, in which rise Mounts Hood, Ida, and others; also on the north of the Columbia are St. Helen, and other mountains still further north, which are of a conical form, and of such height as always to be clothed with snow, while it seldom falls in the plains. These extinct volcanos, although probably not so high as the Rocky mountains, appear covered with snow at a less elevation, proving the truth of the suggestion, that constant congelation descends much lower on detached mountains, than on elevated plains in the same latitude.

By the following meteorological observations, it will be perceived, that the winters on the Columbia are remarkably mild, there being no snow, and the river being obstructed by ice but a few days during the first part of January. Grass remained in sufficient perfection to afford good feed; and garden vegetables, like turnips and carrots, were not destroyed, but no trees blossomed till March, except willows, alders, &c. Often a frost in clear nights, from Oct. till May.

The difference in temperature in winter, between the eastern and western sides of our continent is indeed very great; even more striking than between the Atlantic side and Europe. It now appears a settled fact, that the eastern sides of the two great continents are much colder in the same latitude than the western, and need we seek further for the cause, than the prevalence of westerly winds in the northern temperate zone, bringing the tempered air of the oceans over the land; and in winter, the wind from the same direction, bearing on the accumulating cold to the eastern sides of the continents.

A return from the Columbia river by water around Cape Horn, touching at the Sandwich and Society Islands gave some opportunity to observe the winds and other phenomena; but having said much already, only one thing more shall be added. During three weeks stay at Tahite, the tide was observed to rise about one foot, and always highest at twelve o'clock, noon and midnight, and I was informed that this is always the case.

II. Meteorological Observations, *made at Fort Vancouver, on the Columbia River and vicinity, in* 1832 *and* 1833.

November.

Days.	Morn.	Noon.	Wind.	Weather.
1		52	W.	
2		52	N.W.	Clear.
3	32	55	"	"
4	"	55	"	"
5	"	"	E.	"
6	"	"	"	"
7	"	"	"	"
8	"	"	N.W.	"
9	"	"	"	"
10	"	"	E.	"
11	"	"	"	"
12	"	"	"	"
13	"	"	"	"
14	"	"	"	"
15		"	S.E.	Rain.
16		58	N.W.	Clear.
17		50	E.	"
18		45	S.E.	Rain.
19		45	"	"
20		50	"	"
21		50	"	"
22		46	N.W.	Cloudy.
23		50	"	"
24		50	S.W.	Showery.
25		50	S.E.	Rain.
26		50	"	"
27	48	50	"	"
28	"	54	N.W.	Cloudy.
29	32	49	"	Clear.
30	32	49	"	"

Not observed.

December.

Days.	Morn.	Noon.	Wind.	Weather.
1	40	40	S.E.	Rain.
2	40	42	"	"
3	48	50	"	"
4	40	47	"	Pleasant.
5	41	48	"	Rain.
6	40	47	"	Pleasant.
7	32	40	"	"
8	32	40	N.W.	Cloudy.
9	38	44	S.E.	Pleasant.
10	37	43	"	Rain.
11	38	42	"	"
12	38	42	"	"
13	38	46	S.	Showery.
14	38	43	S.E.	Rain.
15	44	54	S.	"
16	50	48	N.W.	"
17	53	55	S.E.	"
18	52	51	"	"
19	44	49	"	"
20	45	48	"	"
21	42	46	S.	Showery.
22	40	41	"	Rain.
23	40	43	"	Showery.
24	41	44	"	"
25	39	44	"	"
26	40	46	S.E.	Rain & Shine.
27	40	45	"	"
28	41	43	"	Rain.
29	41	43	N.W.	Showery.
30	36	42	"	Pleasant.
31	32	44	"	"

January.

Days.	Morn.	Noon.	Wind.	Weather.
1	32	40	N.W.	Cloudy.
2	35	40	"	"
3	38	45	"	"
4	38	42	"	Clear.
5	32	43	E.	"
6	32	39	"	"
7	32	38	"	"
8	28	35	"	"
9	25	34	"	"
10	32	32	"	"
11	32	40	"	"
12	25	37	"	"
13	18	33	"	"
14	17	32	"	"
15	17	33	"	"
16	20	33	"	"
17	20	28	"	"
18	26	39	S.E.	Hail.
19	34	40	"	Rain.
20	44	55	S.	Showery.
21	54	55	"	"
22	54	58	S E.	Rain.
23	52	54	"	"
24	40	48	"	"
25	32	42	N.W.	Pleasant.
26	32	44	"	"
27	40	50	S.	"
28	40	46	S.E.	Showery.
29	39	44	Varies.	"
30	39	45	"	"
31	40	47	"	Pleasant

February.

Days.	Morn.	Noon.	Wind.	Weather.
1	40	47	Varies.	Showery.
2	40	46	S.E.	"
3	46	52	"	Pleasant.
4	46	50	"	Rainy.
5	45	51	"	"
6	47	51	"	"
7	43	47	N.W.	Pleasant.
8	43	47	"	"
9	40	44	N.E.	"
10	32	45	"	"
11	32	45	S.W.	"
12	38	46	"	Showery.
13	38	48	S.	"
14	40	50	"	Pleasant.
15	42	50	W.	Showery.
16	33	45	S.	Cloudy.
17	40	50	"	Rain.
18	41	50	S.E.	"
19	43	51	S.	Showery.
20	40	53	N W.	Pleasant.
21	42	50	"	"
22	37	45	"	"
23	32	44	"	"
24	32	44	"	"
25	32	45	"	"
26	32	50	W.	"
27	32	55	E.	"
28	32	55	S.E.	"

March.

Days.	Morn.	Noon.	Wind.	Weather.
1	40	50	S.E.	Rain.
2	32	55	N.W.	Clear.
3	"	55	"	"
4	"	57	"	"
5	"	57	"	"
6	"	58	"	"
7	"	59	"	"
8	"	60	"	"
9	"	60	"	"
10	"	55	s. to w.	Cloudy.
11	"	56	"	"
12	"	50	"	Rainy.
13	38	51	"	Cloudy.
14	38	50	"	"
15	37	"	"	"
16	38	"	S.	Showery.
17	38	"	"	"
18	32	"	W.	Cloudy.
19	"	58	"	Pleasant.
20	"	51	s. to w.	"
21	40	55	"	"
22	32	50	S.E.	Rain
23	"	"	"	Pleasant.
24	"	"	"	"
25	"	"	s. to w.	Showery.
26	"	55	"	"
27	"	60	"	"
28	"	59	"	"
29	40	56	"	"
30	39	55	"	"
31	40	"	"	"

April.

Days.	Morn.	Noon.	Wind.	Weather.
1	32	50	s. to w.	Showery.
2	"	58	N.W.	Clear.
3	40	51	S.E.	Rain.
4	"	49	W.	Clear.
5	"	50	"	Showery.
6	"	45	"	Hail.
7	"	66	s. to w.	Rain.
8	"	51	"	Hail.
9	"	50	"	Rain & Shine.
10	"	50	"	"
11	"	54	"	"
12	32	60	E. to W.	Clear.
13	"	61	"	"
14	"	68	"	"
15	"	70	W.	Cloudy.
16	38	63	"	Rain.
17	40	65	"	Cloudy.
18	40	60	"	"
19	32	55	S.	"
20	39	55	"	Rain.
21	40	63	"	Cloudy.
22	"	65	W.	"
23	"	60	"	Showery.
24	"	60	"	"
25	"	56	N.W.	Pleasant.
26	"	51	"	"
27	32	45	"	"
28	"	50	"	"
29	"	51	W.	Cloudy.
30	41	50	S.E.	Rain.

May.

Days.	Morn.	Noon.	Wind.	Weather.
1	38	50	S. to W.	Showery.
2	32	54	N.W.	Clear.
3	"	55	"	"
4	"	"	S.W. Thun.	show'rs.
5	39	"	S.E.	Cloudy.
6	40	"	"	Rain.
7	41	"	W.	Showery.
8	41	"	"	"
9	42	"	"	"
10	45	60	N.W.	Clear.
11	"	75	"	"
12	"	"	"	"
13	"	65	W.	Showery.
14	"	61	"	"
15	"	60	"	"
16	"	65	"	Cloudy.
17	"	61	"	"
18	"	62	"	Clear.
19	"	65	S.	"
20	"	67	S.W.	Showery.
21	"	70	W.	"
22	"	70	S. to W.	Cloudy.
23	"	67	"	"
24	54	65	"	Clear.
25	41	68	"	"
26	40	75	S.	"
27	40	72	"	"
28	55	70	"	"
29	56	70	"	Cloudy.
30	60	71	S.E.	Rain.
31	"	"	"	Showery.

June.

Days.	Morn.	Noon.	Wind.	Weather.
1	50	70	S. to W.	Showery.
2	"	"	"	"
3	"	"	"	"
4	"	"	"	Cloudy.
5	"	80	"	Clear.
6	"	"	E. to W.	"
7	"	"	W.	Showery.
8	"	75	"	Cloudy.
9	"	76	"	Clear.
10	"	78	N.	"
11	"	92	"	"
12	55	95	"	"
13	"	88	"	"
14	"	88	"	"
15	"	72	W.	Cloudy.
16	"	55	S. Thun.	show'rs.
17	"	70	S. to W.	Cloudy.
18	"	"	"	"
19	50	75	N.E. to W.	Clear.
20	"	"	"	"
21	"	"	"	"
22	"	"	"	"
23	"	"	"	"
24	"	80	"	"
25	"	70	"	Cloudy.
26	"	"	N.W.	"
27	45	"	"	"
28	"	"	"	"
29	"	"	S.E. to W.	"
30	60	80	"	"

July.

Days.	Morn.	Noon.	Wind.	Weather.
1	60	80	N.W.	Pleasant.
2	55	85	"	Clear.
3	53	80	"	"
4	55	80	W.	"
5	53	84	E. to W.	"
6	46	78	"	"
7	59	79	S.E. to S.W.	Showery.
8	60	75	"	"
9	53	80	"	Cloudy.
10	60	81	"	"
11	53	74	N.W.	"
12	47	79	"	Clear.
13	52	95	"	"
14	56	91	"	"
15	47	84	W.	"
16	50	85	"	"
17	47	78	"	Thunder.
18	52	80	E. to W.	"
19	45	85	N.W.	Cloudy.
20	41	82	N.	Clear.
21	54	73	"	"
22	40	81	"	"
23	43	83	S.W.	"
24	54	78	"	"
25	48	76	N.W.	Cloudy.
26	44	82	E. to W.	Clear.
27	45	85	"	"
28	48	80	"	"
29	50	81	"	"
30	55	82	N.E.	"
31	55	85	"	"

August.

Days.	Morn.	Noon.	Wind.	Weather.
1	53	93	Northerly.	Clear.
2	53	93	"	"
3	53	93	"	"
4	52	93	"	"
5	48	83	"	"
6	50	85	Southerly.	"
7	52	72	"	Cloudy.
8	58	72	S.W	"
9	60	69	"	"
10	55	75	W.	"
11	53	77	"	"
12	54	80	N.W.	"
13	46	80	N.E.	"
14	47	87	"	"
15	47	83	"	"
16	53	78	N.W.	Cloudy.
17	44	78	"	"
18	50	77	S.E.	"
19	53	72	W.	"
20	53	77	N.W.	Clear.
21	46	"	"	"
22	55	"	"	"
23	50	"	"	"
24	52	"	"	"
25	48	81	N.E.	"
26	52	95	E.	"
27	47	90	S.W.	Cloudy.
28	63	77	"	"
29	56	79	"	"
30	59	69	"	Showery.
31	52	67	"	"

September.

Days.	Morn.	Noon.	Wind.	Weather.
1	52	65	N.W.	Showery.
2	54	71	"	"
3	47	73	"	Cloudy.
4	44	81	"	"
5	54	76	"	"
6	43	79	N.	Clear.
7	44	76	"	"
8	47	85	"	"
9	55	88	"	"
10	53	80	S.	"
11	50	78	"	Cloudy.
12	51	69	S.W.	Rain.
13	48	67	"	Showery.
14	54	60	W.	"
15	50	65	Varies.	Cloudy.
16	51	69	"	"
17	48	67	"	"
18	54	71	"	"
19	48	67	N.E.	Clear.
20	48	72	"	"
21	55	74	Varies.	"
22	57	75	"	Rain.
23	53	78	"	Cloudy.
24	56	79	"	"
25	60	62	N.E.	"
26	55	58	S.E.	Rain.
27	52	70	"	Cloudy.
28	50	57	S.W.	Rain.
29	52	62	N.W.	Cloudy.
30	51	62	"	"

October.

Days.	Morn.	Noon.	Wind.	Weather.
1	50	56	S.E.	Cloudy.
2	55	66	"	Rain.
3	53	62	N.W.	Squally.
4	52	56	N.E.	Clear.
5	52	66	"	"
6	50	65	W.	Cloudy.
7	51	63	"	"
8	52	63	E.	"
9	52	62	S.E.	"
10	55	63	"	Rain.
11	55	64	W.	"
12	52	63	N.W.	Cloudy.
13	51	60	"	"
14	52	58	"	"
15	50	58	"	"
16	50	55	E.	"
17	50	55	"	"
18	50	57	"	Clear.
19	"	55	S.W.	Cloudy.
20	"	52	"	"
21	"	52	"	"
22	"	54	"	"
23	"	55	"	"
24	"	60	"	"
25	"	56	S.E.	Clear.
26	"	55	E.	"
27	"	51	S.W.	Rain.
28	"	50	S.E.	"
29	"	55	"	"
30	"	50	"	"
31	"	50	"	"

III. Miscellaneous Facts.

In answer to various inquiries addressed by the editor to Mr. Ball, after the perusal of the foregoing communication, he has been so obliging as to add the following notices which, we cannot doubt, will add to the interest of his valuable paper.

Events, Commencement and Motives of the Journey.

Mr. Ball left Baltimore, March 27, 1832, and passed by the rail road, and national road to Brownsville on the Monongahela, thence by steamboat to the Ohio, and then down that river, and up the Mississippi and Missouri, to Lexington, in the State of Missouri, where, he and his companions arrived April 29. He did not describe the countries, whose geological sections are so well exhibited on the rail roads and the rivers, because it has been done by others. Leisure, a strong desire to roam, especially to see the vast and untamed regions of the utmost west and the solemn ocean-barrier of the immense Pacific, rather than motives of personal advantage, induced him to unite himself to a party of adventurers, who were about to cross the Rocky Mountains.

On the 7th day of May, 1832, says Mr. Ball, we, the twelve who crossed the continent, with about as many more, who *started* with that intention, joined ourselves to a trading party of about seventy men, headed by a Mr. Wm. Sublette, and commenced our march, crossing the line of the State, of Missouri on the 13th, as stated in my communication. The whole band of horses and mules used for the purpose of riding and packing goods, amounted to almost three hundred. We marched and encamped in the usual way of fur traders, always prepared to act on the defensive ; and after being out a few days, subsisting entirely by the chase,—were, one night, on the mountains, fired upon by the Black Foot Indians, and lost some horses ; and at another time, had a battle with Indians of the same tribe, when five trappers were killed. On the Lewis and Columbia, we subsisted chiefly on Salmon—at one time, we had nothing for four or five days, except for the two first days, some small fruit—but we had horses with us, and of course, ran no risk of starvation.

The difference of longitude between St. Louis and the mouth of the Columbia, is about 34° ; therefore, by making an allowance of about 7° difference of latitude, with the diminished distance between the parallels of longitude, I estimated the direct distance to be about eighteen hundred miles. The entire distance which we travel-

led with horses at two thousand miles, while my companions considered it much greater; the distance up the Missouri and down the Columbia, travelled by water, at seven or eight hundred miles; therefore the whole distance travelled, from St. Louis, was about twenty eight hundred—one thousand more than the direct distance. The distance I travelled by land, was, in all, say five thousand, and by water, twenty thousand, equal to twenty five thousand, or the entire circumference of the globe.

Rocks, Springs and Physical features.

As to the rocks, you have, I presume, specimens from the Sandwich or Society Islands; for, although I have said that there is no appearance of craters, on the continent; still the general aspect of the rock, is often precisely the same as in those Islands—black porous masses of a specific gravity little less than granite—is it not amygdaloid? The basalt on the Columbia more resembles the specimens of the Giant's Causeway, than the rock on the west of the Hudson, the Palisadoes, and that near your residence at New Haven. In fact, all the rocks show much stronger marks of ignition. I brought a few small specimens, which I wish you could see. I saw no *currents* of lava, or masses flowing through vallies, unless the columnar basalt, resting, sometimes on sand, along the Lewis and Columbia rivers, are to be considered such. I saw no pumice stone, but what I spoke of as cinders or scoriæ, would perhaps, be better described as resembling almost precisely over burnt brick or earthen ware. At the top of the deep ravines through which the creeks ran, the rocks sometimes presented that appearance, as though it *there* underwent the greatest heat. I do not recollect that I saw any dykes or walls of trap or lava or basalt, presenting an appearance as though intruded through other rock, or any volcanic craters or *balls* or lips of eruption-shapes or forms, except Mount Hood, &c. I earnestly wish it were in my power to describe the country so that you could *see* it, for it is well worth seeing.

The rock often had a vitrified appearance, and although not exactly tumefied, it presented pores of all dimensions, even to the capacity of twenty gallons; these cavities are of a kettle form—and the rock that was burnt differed as much from that which was not, as burnt brick or earthen from the clay from which they are made, or glass from the silex. Sometimes I thought the rock to be basalt, which, on the slightest examination, could be seen to be, at least in

places, as evidently mica slate, or granite or sandstone, as though it had not equally strong marks of ignition. Did not the whole undergo this change from heat, when under water? May not a country undergo a baking or hardening, the gases escaping through crevices and fissures, without forming craters.

As to streams and springs, we often met with brooks of a size to carry a flour mill, coming out of the cavernous rock; they were of the usual temperature of the water at the same season in the rivers, and except along one creek, we saw but few springs, that were remarkably warm. On this they were very abundant, gushing out of the cavernous bluffs, at the temperature of 100°, and in sufficient quantity to warm the water of a creek forty yards wide, so as to render it unpleasant to drink—I saw no jetting springs, or those boiling from gas.

The whole country over which we travelled, for more than a thousand miles before reaching the ocean, presents these appearances of ignition, with the exception, perhaps, of one eighth part of the rocks. The soil was in most places barren, till you approach the ocean, for there is not a sufficient quantity of water retained near the surface to promote vegetation, the soil being porous, and the supply of rain is small.

Cultivation of Land—Departure.

In March of 1833, having no opportunity to leave the country, except by recrossing the mountains, and not knowing what might occur in the course of six months, I procured seeds, implements, &c. of the Hudson Bay Company, went up the Multnomah river about fifty miles from the fort, where some of the Canadian French, and half breeds had commenced farming, and with the help of one American and an Indian, enclosed some prairie ground, built a log house and raised a crop of wheat—and would have remained in that country could I have had a few good neighbors as associates, for I did not feel inclined to fall into the customs of the country and become identified with the natives. Therefore on application to the Company, about to send a ship to the Sandwich Islands, in the ensuing October, I obtained a passage—for the company were, in this, and in every thing, polite and accommodating. Of the twelve who reached the Columbia, one died, three re-crossed the mountains, the others, except myself, went to sea in the Pacific, or into the employment of the Company.

The North Western Coast.

On the 18th of Oct., 1833, we sailed from the Columbia river, for California. The coast is bold and the country immediately back consists principally of broken mountains, clothed with trees at some distance down the coast, but before you reach the Bay of St. Francisco, the country becomes prairie. So the continent below the latitude of 40° appears to be entirely prairie from the Pacific to Missouri, Arkansaw and Texas; with the usual exception of timber growing, occasionally, on the rivers and mountains. Mules have been bought in Upper California and brought to the American market.

The country about the Bay of St. Francisco, is beautifully diversified with hills, mountains and plains, with occasionally a clump of trees; on the plains, graze immense herds of horses and cattle both wild and tame. The rock, as far as observed, was supposed to be Serpentine. The climate was delightful, for the range of the thermometer, during most of the month of Nov. was from 52° to 58°, and the sky serene—and it is said they never have frost, although in the latitude of St. Louis, Cincinnati and Washington. The temperature at sea till we reached the trade winds, was from 50° to 60°; then it gradually rose till, at the Sandwich Islands on the first of January 1834, its range was from 70° to 77°; I was informed that it sometimes rises as high as 85°. The greatest range is probably about 15°, the air being always tempered by the breezes from the sea, producing a delightful climate.

Features of Oahu.

As you approach the Island of Oahu, you behold high and precipitous mountains of curved, spiral and fantastic forms, rising to the height of from three to four thousand feet, and as you approach nearer, you will see rising from the plains along the coast, to the height of a few hundred feet, crater-formed hills, which although now clothed with grass, are of as perfect symmetry as they were when emitting flames. About one mile back of Honolulu, the principal town of these Islands, rises one of these craters, called the *Punch Bowl*; you at first ascend over a gradual slope where you see coral rocks partially burned, elevated some two or three hundred feet above their original place at the level of the ocean. Then the ascent is more abrupt, winding by a zigzag path, till one stands on a rim of rock, and before him sees a beautiful grass-clad basin, of about half a mile in circuit, surrounded by a similar rim, except at one place, where it is broken away to the depth of the basin.

Volcanic and Coral Rocks.

Not a fragment of rock was found at this or the Island of Tahiti, except what was volcanic or coral, and none is said to exist in those seas. Did the waves of the ocean once roll from America to China and New Holland, without an islet to interrupt their course, till the coral insect raised up its circular wall, from within which, the volcano burst forth? For, the low coral islands are generally of a crescent or circular form, and around the mountainous islands are found coral reefs. The Sandwich and Society Islands are all mountainous, each cluster containing about ten islands. In crossing the equator, and generally between the tropics, the same phenomena were observed on that side, as observed by Humboldt on this. The temperature was from 80° to 83°, the currents of the water and air were westward, but the upper strata of clouds show the wind above to be in the opposite direction. The temperature of the water was generally 81°.

Society Islands.

The approach to the Society Islands, presents a truly romantic appearance, and when we reached their reefs and sandy shores, shaded with cocoa trees and backed by varied and rich vegetation, we could feel no surprise at the delight of the seamen, so often described. Still, the number of the natives is said to have diminished one half in twenty five years, although the climate appears not unhealthy; but the generous natives of these numerous islands, pass away as do those of the American continent at the approach of Europeans.

Passage around Cape Horn—Arrival.

We passed Cape Horn the first of May; when above lat. 50°, we had frequent squalls of snow and hail, but it froze only once, and then when directly off the Cape, the water was at 43°, while the air was from that down to 32°, and extremely damp, the sun being, at noon, but 17° high in the north.

We hear much of the uniformity of the Trade winds, but in that ocean the winds above 30° of N. and S. lat., appear to blow almost as constantly from the west as the trades from the east. There is always a difficulty in getting from the Atlantic into the Pacific, but in returning, the wind, as uniformly, favors the navigator. That ocean, from its extent, gives the winds their natural play, let the reason of their courses be what it may. Stopping at Brazil, we reached Norfolk on the 16th of July last, and this place on the 22d, and observed, in this ocean, similar phenomena to those seen in the other.

ART. II.—*Extracts from an Itinerary of a Journey in Spain, in the spring of* 1833, *containing a sketch of the actual condition and future prospects of the mining industry of that country*; by F. LE PLAY, Engineer of mines. Translated by Prof. J. Griscom.

UNTIL very lately, Spain has remained almost entirely without the circle of observations which have described with so much precision, the physical character of the greater part of Europe. Nevertheless, the numerous chains of mountains which so decidedly characterize its surface, and produce such singular variations of climate; the recollection of the mineral treasures extracted from its bosom at various periods, and in fact the relations of travellers who have visited the peninsula, sufficiently prove that the study of this country must be highly interesting to the naturalist, and that the miner especially may derive from it the most useful lessons. The causes of our ignorance of the natural history of Spain are easily perceived: political events have not allowed the nation to share in that progress which has been impressed upon the sciences, since the close of the last century, in the other countries of Europe. It may even be said with truth that during the greater part of this period, its scientific institutions have experienced a gradual decline, which the zeal of a few enlightened and isolated men has not been able to withstand. Spain, therefore, has been unable to yield her contingent to the mass of observations which forms the basis of a complete description of the European continent. Learned foreigners have scarcely taught us any thing with respect to the Peninsula; and while numerous travellers have been exploring the most remote countries, and erecting distant posts for a grand geological triangulation of the surface of the globe, all seem to have forgotten that there exists in Europe a country which in some respects is scarcely less known than the least frequented portions of the old and new continent.

If the Pyrenees have hitherto been the barriers which naturalists have but rarely overleaped, it is doubtless owing to the frequent accounts which they have heard of the difficulty of travelling, and the dangers which foreigners must experience in the midst of so imperfect a state of civilization. But these obstacles, which have been much exaggerated are daily diminishing: in the Spanish part of the Peninsula, the most important places are now connected by good

lines of communication. For several years past, Madrid has maintained a regular correspondence with most of the provincial capitals; the road from Bayonne to Cadiz, is as good as any on the continent, and might be travelled with the same celerity as the best regulated roads of France, if old customs and unfounded fears did not oppose the travelling by night. The time is doubtless not very distant when Spain will become the most interesting portion of a continental journey, and will take from Switzerland and Italy the supremacy which they have so long enjoyed.

The retrograde march of this country in internal improvement, has within ten years been arrested. Her mining industry, especially, has been very instrumental in effecting this pacific revolution.

Spain has been celebrated, for many ages, on account of her mineral riches. Next to Italy, Pliny regarded this country as the most beautiful province of the Roman Empire. He relates that in his day, mines of lead, tin, iron, copper, silver, gold and mercury were explored to a great extent. The Moors, who were no miners and who rarely ever employed hewn stone in the construction of their edifices, gave no impulse to this activity, but yet they continued in operation several mines in the west of the Peninsula. But the conquerors of these people destroyed almost every vestige of this species of civilization, and the discovery of America gave a final blow to the art of mining in Spain. With a view to favor the search after the precious metals in the new world, the king of Spain interdicted by severe penalties, the working of mines in the Peninsula, reserving only an exclusive privilege which they sometime hired to individuals.

The quicksilver mines of Almaden, whose produce was absolutely necessary to the exploration of the precious metals in New Spain, remained almost the only ones in operation, and sent every year to Mexico, from five to six thousand quintals of mercury. About the middle of the last century, a quicksilver mine in Peru, having become exhausted, a fresh activity was given to those of Almaden, which extended the annual production to eighteen thousand quintals. Various causes, however, chiefly political, again interrupted the mining progress, so that in 1820, with the exception of Almaden, the iron mines of Biscay and a few others, the search for metals was in a state of complete neglect.

The country, however, about this time, became awakened to the danger, and on the 4th of July, 1825, a mining law was enacted,

agreeably to the report of Don V. de Elhuyar, which placed the mineral enterprize of Spain, upon nearly the same basis as that adopted by the Legislature of France.

These liberal provisions soon produced happy fruits, and in the kingdom of Grenada in particular, private industry effected, in the course of three years, the most unexampled results. The population of the mountainous country of Alphajanes, which since the expulsion of the Moors, had lived in a state of extreme misery and demoralization, was suddenly aroused from its apathy, in learning that an odious monopoly had ceased to exist, and ardently directed its attention to the lead mines so abundant in that country. Success surpassed the most extravagent expectations. In a few months, some of the poor peasants, whom good fortune had favored, found themselves in possession of a handsome property. Researches were multiplied almost infinitely, and in 1826, more than thirty five hundred mines had been put in action in the *Sierras* of Gador and *Lujar*. In midsummer 1833, I was informed that more than four thousand shafts were sunk in the single Sierra of Gador. Prior to 1820, the royal establishments, which alone, had the privilege of smelting the ores which they bought at the price the government chose to fix, produced only from thirty to forty thousand quintals, of lead per annum. In 1823, that is three years after the earliest enterprizes, the production arose to five hundred thousand quintals. In 1827 the period of the greatest prosperity, the production of this metal rose to the enormous quantity of eight hundred thousand quintals. Since that time, it has remained nearly stationary.

This prodigious developement of industry in so short a period, made a great sensation in Spain, and it is difficult to form an idea of the ardor with which all classes of society directed their speculations to mining operations. Every one seemed to think he had only to dig into the earth to discover an inexhaustible treasure. Unhappily, the want of knowledge, more than lack of capital baffled the greater number of these enterprizes. It was not with impunity that Spain had withstood, during thirty years, the progress of science in the rest of Europe.

The sudden developement of mineral wealth in the kingdom of Grenada had, however, greatly enlightened the government. They plainly perceived it to be their interest to combat the prevailing ignorance, which had so long kept concealed the the source of so much wealth. All sorts of encouragement were given to the art of

mining. Two schools were created, one at Madrid, the other at Almaden. Many pupils were sent to the school of Freyburg in Saxony, to study the art of mining as practised in that part of Germany, and doubtless it may be expected from the new turn of affairs in Spain, that pupils will be sent to collect new light in other schools not less celebrated nor less respectable.

Many distinguished men who had been banished from Spain in consequence of their politics, had turned their attention, in foreign countries, to mining and other arts of wealth and industry. The greater number of these were recalled, and demonstrated that they had turned their exile to a useful purpose. One of them, Mr. Vallejo who acquired in the schools of Paris a taste for mineralogical science, has been appointed to furnish a geological description of Spain, and is now engaged in fulfilling his appointment. Al de Erlorza, an officer of Artillery, after studying the modes of working iron among the bloomeries and furnaces of England, Belgium, Hartz, Piedmont, and France, has been appointed to introduce the best of these methods into Spain; and the rich iron ores of Marbella and Pedroso, (Andalusia) are now treated in well erected works, in which this skilful engineer has adopted the most recent improvements to the local condition of that region. These improvements have extended to Galicia, and will doubtless, by degrees, reach the various localities in the north of Spain.

During the short period just adverted to, the exploration of other mineral substances has also received a new impulse. The production of mercury in the country of Almaden, is again increased; the ancient copper mines of Rio-Tinto, quite neglected during the free importation of copper from the western side of South America, have been pushed with activity since the revolt of the colonies. The powerful deposits of Calamine at Alcaraz, in the eastern part of La Mancha are now worked with success. The lead mines of Lanares in the kingdom of Jaen and of Talsete in Catalonia have furnished notable results, notwithstanding the formidable rivalship of the Sierra of Gador. In the environs of Oviedo in Asturias extensive mines of coal, which unhappily are not within reach of the coast, send their products, in increasing abundance, to the metallurgic establishments of the Andalusian coast. In the same province, but in a more favorable situation near the river Aviles, a company is beginning to explore the same coal formation. These mines, whose principal galleries open upon the sea coast, are preparing to export their

fuel; and there is no doubt that these will soon arrive in the harbors of the Garonne, the Charente and the Loire, and that the mines of Aviles are destined to a high state of prosperity. In another part of Spain, the little coal fields of Villa-Nueva-del-Rio, situated eighteen leagues above Seville, are wrought with increasing activity, and furnish a good combustible for the steamboats, which now perform the route from Seville to Cadiz in twelve hours.

One could not expect to find in Madrid, those scientific institutions and fine collections, which in the other capitals of Europe, enable the naturalist to take a general survey of the productions of the various provinces. There is nevertheless, a cabinet of natural history in which the mineral kingdom is represented by specimens of great richness, and derived both from the Spanish mines and from the South American Colonies. Unhappily, this collection is in the state in which the science of Charles III. placed it. Latterly, the government has created at Madrid a school of Mines, several parts of which have been furnished in a very sumptuous manner. The direction of the mines, however, has not yet realized the hopes which had been expected by the erection of this school. It is difficult to bring young men together who are sufficiently conversant with the elementary branches of science. The pupils are besides, deprived of the very indispensable means of instruction both of a good library and of collections of ores and machines: in these respects, every thing is yet to be done.

The large village of Almaden, situated on the crest of those rich veins, which have rendered this country classical to every miner, reminded me of the villages of Zellerfeld and Clausthall in the Hartz, identified like those in the mineral beds which gave rise to their erection. Almaden resembles the Hartz also in the German manners of its inhabitants, gradually introduced at various periods:—thus, after wandering for a month in the midst of a civilization which I could scarcely comprehend, I found myself happy in meeting on the confines of La Mancha, among the miners of Almaden, the same fraternal feelings which revived the agreeable recollections of a journey, which I had made three years before, in the north of Germany.

The mines of Almaden, situated in the province of La Mancha, near the frontier of Estremadura and the kingdom of Cordova, exhibit as great activity and industry as the most celebrated of the Hartz, of Saxony and of Hungary.

They were worked at a very remote period, since, according to Pliny, the Greeks obtained vermillion from them seven hundred years prior to our era. The same author tells us they were also worked by the Romans, and that Rome drew annually from them one hundred thousand pounds of cinnabar.

I found the business of the mines in the most flourishing situation. At the period of the year when the laborers are the most active, more than seven hundred workmen, who succeed in each in three different divisions of the twenty four hours, are employed in the various subterranean labors; two hundred more work on the surface, in extracting, transporting, &c. Numerous muleteers are constantly occupied in carrying the mercury to Seville, and in bringing back to the mine, iron, wood, powder and provisions of all sorts. The veins are so productive that notwithstanding that the operations have been carried on during so many centuries, they have not yet attained a depth of three hundred metres. In the workings now going on at the bottom of the principal vein, the mass of ore, which is free from unproductive portions, is from twelve to fifteen metres thick: and this thickness is still greater at the point of intersection. The whole mass of the vein is taken out and immediately treated in the distilling furnace, without any kind of mechanical preparation. It yields ten per cent of mercury, but the medium production is probably considerably higher.

Mercurial ore is obtained, not only in the mines just spoken of, but at a great number of points, in the direction of a zone which, passing through Almaden extends, like the principal veins, from east to west over a length of two myriametres, from the village of Chillon to beyond Almadenejos. This last village is itself the center of important mineral operations. Several mines, in the neighborhood, furnish ore like that of Almaden: they formerly were very productive, but the old veins being nearly exhausted, little is doing now except in extending the research. The furnaces of Almadenejos are fed, almost exclusively, by an ore recently obtained on the east of the village: it is a black schist, strongly impregnated with metallic mercury, and in which very little cinnabar is visible.

These ores are treated in thirteen double furnaces called *Buytrones* in which the reduction is effected by the Spanish process and in one large quadruple furnace, recently constructed on the model of that of Idria. · The enclosure containing the metallurgic works of Almaden, includes eight Buytrones with the Idrian furnace. The five other Buytrones are at Almadenejos.

The pleasure which the activity of this region affords to a miner, is not without alloy. The mercury exerts a baneful influence on the health of the workmen, and it is painful to see with what eagerness, young people in robust health, contend for the favor of exposing themselves to the risk of severe disease and often of premature death in these mines. The population of the Almaden miners excites a lively interest. They are recruited, principally, in the villages of La Mancha, of Estremadura, and even of Portugal, whose inhabitants come over, in crowds, to seek for employment, in the intervals of agricultural labor. It furnishes excellent workmen for the mines of Estremadura, who labor faithfully for the most moderate wages. Those travellers who are so prone to brand the Spanish people with the vague accusation of idleness, must have drawn their conclusions from the exterior of some of the villages, where misery and beggary have a tendency to brutalize the manners. They might have found in Estremadura, in the lowest ranks of the social scale, an active and laborious people, retaining all the energy of the conquerors of Peru and Mexico, and exhibiting all their virtues whenever the means of exercising them are brought into activity.—*Annales Des Mines.*

ART. III.—*Notices of Egypt—in a letter to the Editor from an American gentleman, dated on the Nile, July 30th, 1834.*

The Barage.

My Dear Sir,—I have just come from examining one of the greatest projects of the age, and have been thinking that some notice of it might be interesting to the readers of the American Journal of Science. Any one who sails but a few hours on the Nile, will have proof of the great value of irrigation, to these lands. Artificial means for raising the water are in use along the whole stretch of the river, and wherever they are found, a beautiful speck of garden and shrubbery mixed with large trees, are the accompaniments: where such means are not used, the country is quite bare of vegetation and as uninteresting as possible. Indeed, with the present accumulation of rich soil all over the valley of the Nile, the several irrigations of the country during the floods, must be quite as useful to the soil, as the mud deposits. If, by any means then, the river could be raised so as to put it in the power of the farmers to lead the waters over the whole surface of their lands, at all seasons of the

year and in any quantities, it must be evident, that an advantage would arise to the country almost beyond the highest powers of computation. Such a project, Mahomet Ali is about to execute. I have seen nothing any where that will compare with it, in vastness and probable utility, or that, considering all the circumstances, has required more boldness in the undertaking.

You doubtless recollect, that of the seven branches by which the Nile formerly discharged itself into the sea, two only remain, those of Damietta and Rosetta, and that the point of separation is about fifteen miles below the city of Cairo. I must now refer you to the accompanying plan of the improvements, which is from one furnished on the ground, by Monsieur Lenon, the chief Engineer.*

A represents the river before branching: *bb* the Rosetta, and *cc* the Damietta branch. It is proposed to make a dam across at E and *e*, sufficiently high to raise the waters to the level of the banks, and as the valley land immediately adjoining the Nile, as well as the Mississippi and Ganges, is higher than that more remote, it is evident, that if the stream could be brought to such an elevation, it will be an easy matter to carry it to any part of the interior districts, both of the Delta and towards the mountains. In effecting this however, very great difficulties present themselves. Not only is the bottom of the Nile composed of loose and shifting materials, but the banks are also composed of a loam so friable, that as we are now dropping down the stream, our attention is constantly drawn to the plunging of the earth on either side, as it is undermined by the increasing current. Any attempt to build a dam, as is done in our country, would be immediately followed by a washing away of the banks and consequently by a loss of labor; the slight nature of the materials, requires that they should be treated with the greatest tenderness. The engineer commences then, by digging the canals FF and *ff*, each 1300 feet in width and 32 feet deep, being a few feet deeper than the bottom of the river itself: a cross slip L, *l*, being left at the upper end, till the workmen are ready to admit the water. Across these canals at G and *g*, a dam is to be constructed, 41 feet in height and 128 in width or thickness, with sluices sufficient in number and size to admit of the passage of the entire river. When these are com-

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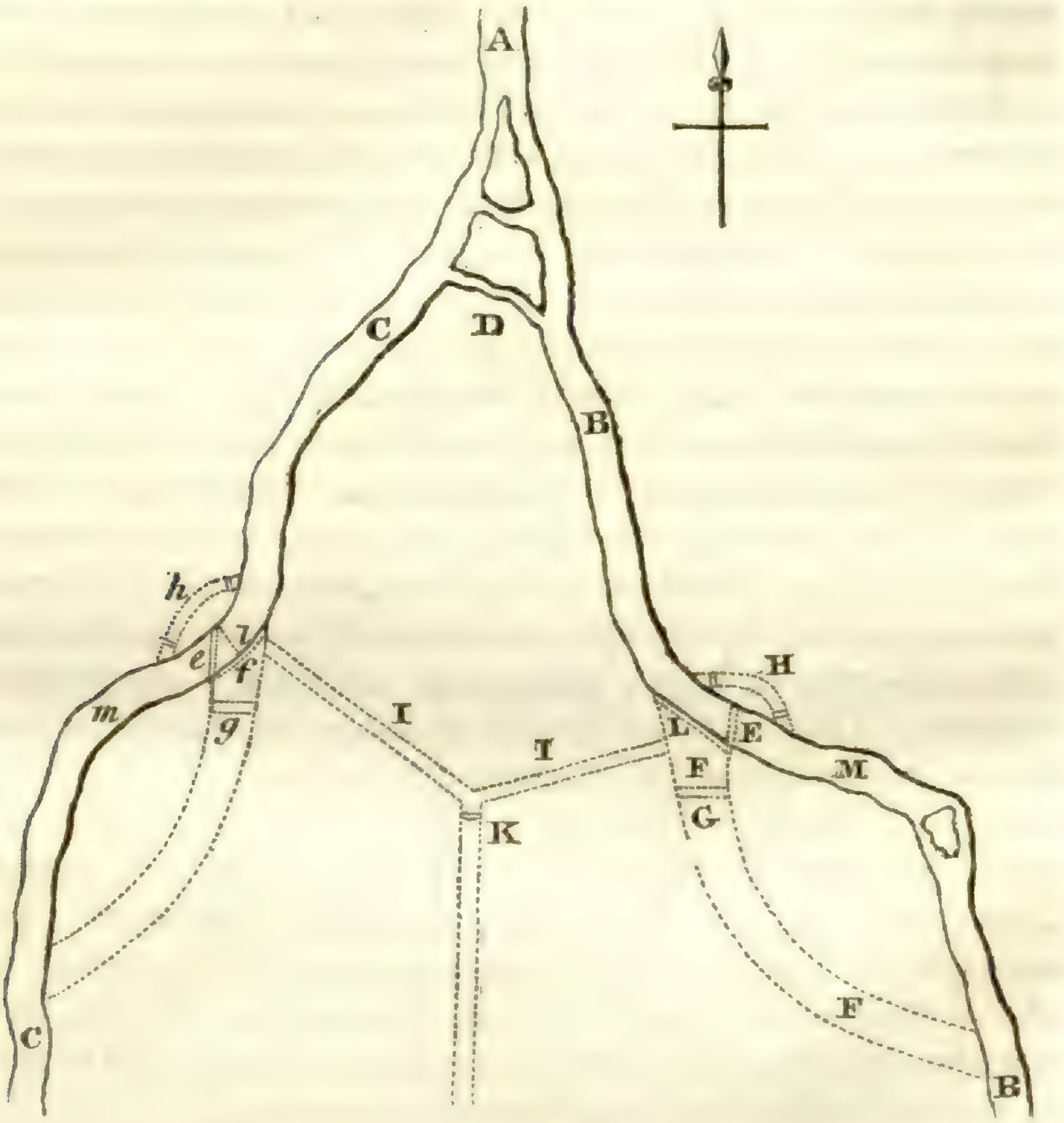
* A reference to Bouriennés Life of Napoleon will shew, that the idea is not original with Mahomet Ali: it is not however the greatness of the conception, but the hardihood in determining to execute it, that astonishes one.

pleted, the cross strip at L and *l* will be removed and the streams, taking a straight course through the larger channels, will leave the present beds M and *m*, nearly or completely dry. Piles will now be driven into the mud, and on them the dams E and *e*, will be constructed, the former 1000 feet, and the latter 820 feet in length, each 34 feet in height. Canals, with locks, will also be made at H and *h* for the passage of boats up and down the stream. I and I are



canals uniting into the larger one K, which will afterwards branch off into an infinity of others, and irrigate the whole length and breadth of the Delta. Others may also be led, in a similar manner, towards the deserts. At K, are gates for checking the admission of the water, when this is necessary.

You will see at once, that it is a prodigious undertaking; but persons in our country, can scarcely form an idea of the difficulties that are to be surmounted. It is, as Mon. Lenon, justly observed, as if he were to commence operations in the Lybian desert itself. He

finds nothing ready to his hand: every thing must be constructed. As we passed over the ground, we found them in one place making carts, in another wheel-barrows, while the whole process of grinding grain and making bread, must be prepared for and carried on, on the ground itself. The piles must be brought from other countries, and the stones of which five millions of cubic metres will be needed, are to be transported from the quarries back of Cairo, a distance of about twenty five miles; they have been thinking of constructing a rail road for the latter purpose, but this has not yet been decided upon.

Mon. Lenon the Engineer, deserves great credit not only for what he has already done, but for several circumstances in which he has consulted the comfort of the workmen, to a degree very unusual in this country. When the canal from Alexandria to the Nile was dug, some years since, a large part of the laborers perished from famine and disease. No pay has ever been given for such work, till the present occasion. Mon. Lenon, has prevailed on the Pasha, to allow 36 paras (4½ cents) per day, to each full grown laborer, and we found them erecting houses for sleeping and also hospitals for the sick. Their provision costs them 6 paras daily, which is deducted from their pay: a laborer on a farm throughout most of the German empire, gets but 4 or 5 cents, exclusive of his food, so that in so cheap a country as Egypt, this may be considered a handsome allowance. They work from sun rise to sun set, with an hour at noon for rest, and at the end of 2 months are exchanged for a new set of workmen. The ground was broken about 3 months since, 6000 men are employed on the Rosetta side, and 4000 on the other branch: Mon. Lenon says that if he can get men enough, the work will be completed in 3 years, but, as matters go, he will probably not be able to finish it in less than 6 or 7: at present, the only utensils in use are a rude hoe for loosening the earth, and a basket, with which it is conveyed on the head and thrown down the bank.

It is a pity, that there should be a dark spot on so fair a project, but it should be added, that the workmen are a most distressing set of objects to contemplate. When a requisition is made, the head man in each village selects the number demanded. They are tied by the neck, in companies of a dozen or more, to a pole, and are thus driven to the ground. We found them in groups of from 10 to 40, each with one or more drivers, and according to the disposition of those men, their pace was a slow walk or a trot: the drivers carry a whip and make abundant use of it.

The place is called Barage, and it is in contemplation to build a city there, to be laid out after the European fashion. They will acquire immense water power, and intend to erect mills and manufactories of all kinds, and Grand Cairo, will, doubtless, find at the Barage, a formidable rival. The whole is now under the superintendence of Mahmoud Bey, late Governor of the former city, and, next to him, of Mon. Lenon the only engineer. The latter is a Frenchman, and is self-taught, but a gentleman of great skill and acquirements. We found Mahmoud Bey in his rich striped tent, and were entertained by him with the greatest hospitality; being served with fruits, confectionary, coffee and tobacco, in pipes set with diamonds. He is the wealthiest individual in Cairo, and from his appearance, I should think Mon. Lenon would find him an agreeable coadjutor, although several of the Beys, from jealousy or ignorance, have tried to throw every obstacle in his way.

Before dismissing the subject, I will add an interesting fact, communicated by Mon. Lenon, that in their digging here, they have found bricks, at the depth of sixty feet from the surface of the ground.

Canal of Mahommadie.

This is another of the great works that shew the expansive mind and enterprizing genius of the present sovereign of Egypt. Fifteen years ago, there was a scarcity of grain in Europe, and an abundance in Egypt; but the shallows at the mouths of the Nile embarrassed the government in its attempts to supply the market. Mahomet Ali then conceived the plan of a canal for the river, to the port of Alexandria. He sent his soldiers into the country; the natives were driven down in crowds, and in a few months, more than one hundred thousand men were at work, along the course which his engineer had selected. They had not even hoes, except to break the hard upper ground; when they came to the softer parts, it was dug out by their fingers, worked into balls, and passed from hand to hand, and thus, in the course of two years, a canal was finished, which has few to rival it in any country. It is fifty miles in length, about six feet in depth and will average about eighty or ninety feet in width. The waste of human life was prodigious. No provision had been made for the workmen, and between twenty and thirty

thousand* of them died along the bank from famine and similar causes; their bodies were stripped and tossed upon the bank, and the earth, from the canal formed their covering. There are no locks, but there is a gate at either end to check the current, which the risings of the Nile would otherwise occasion. It is now the only route of intercourse between Alexandria and Cairo, and is thronged with boats of all sizes, which use sails when the wind is fair, and are drawn by men when it is not. Those for passengers have a fore and after cabin, and would be comfortable enough, were it not for the myriads of bed bugs that infest them: cockroaches also swarm in them, but these are harmless things.

This canal follows, pretty nearly, the line of the one dug by Alexander the Great, till it comes opposite to Damanhour, when it, unaccountably, makes a great bend towards the south and reaches the river a few miles below the town of Fouah. The engineer, (a native) made another blunder in the levelling, by which the canal is nearly dry, during the two months when the Nile is at the lowest.

I was informed at Cairo, that it is in contemplation to construct a rail road from the Red Sea to Cairo, and that contracts for the materials have already been entered into, with some houses in England. A canal was first thought of, but the engineers were found to relinquish this design; it is said, on account of the great difference in the level of the two places, but more probably on account of the sandy nature of the intervening district. The natives are much opposed to the rail road, as it will interfere with the employment of their camels in the portage, but are predicting its failure from the same cause, the floating sands.

The Nile.

Beautiful indeed, was the appearance of this famous river, as it first opened to our sight. We had got well tired of the high black banks of the canal of Mahommadie, when a grove of masts announced its termination; we passed next through the village of Safr, whose houses are too miserable, even for the word hovel: we ascend-

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* It is difficult to get at statistical *facts* in this country. Mon. Lenon told us, that sixty thousand workmen were employed, and that twenty thousand died: a gentleman of veracity, at Alexandria, who saw the work in progress, informed me, that one hundred and fifty thousand men were employed at it, and that thirty thousand perished: he said the Pasha of Menduf alone, drove down fifty thousand.

ed a bank, and from its top looked down, upon a broad mass of moving water. This was the Nile. In America, you meet with rivers every where, and they scarcely excite a sensation of any kind. Along the Mediterranean, however, they are so rare, that they become one of nature's greatest wonders, and the sight of a large stream is really a gratification.

The Nile is about as wide as the Connecticut at Middletown: the deepest boats I have seen on it, would require five feet water: the one in which we ascended drew about four, and yet we frequently grounded: in our descent, we gave ourselves up to the current, and thus, keeping more in the channel, we got along better. At this season, there is, regularly, a strong breeze up stream from morning till late in the evening: boats ascend by aid of sails, and unless they are in a hurry, descend simply by the force of the current. The water of the Nile, for drinking, deserves all the encomiums that have been passed upon it. It is agreeable to the palate, and so light and innocent, that, although we have used prodigious quantities of it, no one has been injured: the wealthier natives, after letting it settle, keep it in thin bottles of porous unglazed earth; these are put in cool places, and all drink indiscriminately, from the bottles themselves. The river is now rising and is about half flood, the water of a deep yellow color; last year it did not reach the usual height, and it is feared this will be the case the present year also, although the rise began earlier than usual.

I have amused myself, whenever we have stopped, at a perpendicular bank, with examining the stratification of the earth. When a fresh vertical fracture or break is made, it is easy to trace the deposits of each successive year, by means of a lighter earth on the top of each, and when a bit is taken into the hand it may be easily made to separate, at those lines, into cakes; but on close examination, the edge of each of these will be often found to be marked by very delicate thin lines, parallel to those where the separation has taken place. I have, several times, been struck with the strong resemblance between these delicate lines and those which you and I saw in the coal at Maunch Chunk and Wilkesbarre. Judging from these strata, the yearly deposits appear to vary very much, but will average a little more than a quarter of an inch. This corresponds also with what Mr. Trail, the superintendant of Ibrahim Pacha's garden, on the Nile at Cairo, told me he considered the average deposit. I have put up specimens of the stratification, and hope to have the pleasure of presenting you with some of them.

Mahomet Ali,

may be considered the greatest sovereign of the age;—he is well worthy of a notice even in a Scientific Journal. We can scarcely travel a mile through the country, without finding some marks of his restless enterprize; and much of this is on a very magnificent scale. The port of Alexandria is filled with his Men of war, the large ships, being all of one hundred guns or more; several more are on the stocks, and the keel of another has just been laid with religious ceremony, the Pasha himself being present among the crowd. Alexandria itself is rapidly improving; the Pasha is erecting a number of large houses on the European plan. Next, we come to the canal of Mahommedie, lined for some miles, with the new summer houses of his officers. Near the further end of it, at Fouah, is a large Cap Manufactory, erected by Mahomet Ali: proceeding up the river we come, at intervals, to his immense granaries: the works at the Barage have been noticed: a little higher up, on the left bank, are the royal palace and gardens of Shubra, the latter* like a work of enchantment: from this, an avenue of Carobe trees keeps along the river the whole way to Cairo, a distance of about three miles: approaching Boulac the port of Cairo, our attention is drawn to a number of buildings with high chimnies, from which the smoke is puffing, as if we were in the neighborhood of Birmingham or Sheffield. They are the Pasha's Cotton manufactories, and Iron founderies, and are said to be but a small part, of what have sprung up within a few years, under this powerful magician. We went through one of the manufactories and found them just putting into operation a twenty horse steam engine from London. The large columns, supporting the second story of the building, were of cast iron, and the looms, of which I counted more than a hundred, were of the same material. It was curious to find this, and also a cotton printing establishment, and a manufactory of machinery attached, all in active operation, and to see the half naked Arabs darting about in their several em-

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* The superintendant of this garden is an Arab: he was sent by the Pasha to France, and spent six years on an experimental farm, near Marseilles. Walking through the garden, we came to a very pretty spot, paved in Mosaic fashion, with pebbles from Rhodes, and having a kind of canopied throne in the centre. "This," he said, "is Mahomet Ali's favorite spot. That pear tree, you see in the corner, is from his native town in Albania, and was planted here by his own hands. He often takes that seat directly opposite, and seems to be fond of watching its growth."

ployments. They are very apt at the business, and appeared to be cheerful and contented. In addition to the foundery at Boulac, the Pasha has also extensive iron works in the Citadel at Cairo, where he is able to manufacture one hundred muskets per day: this manufactory is also in the most active operation. He has also, schools preparatory for civil service, as well as for the army and navy, connected with his palace in the citadel, and has just formed the nucleus of a large establishment of this kind at Toura, about ten miles above Cairo, on the right bank of the Nile. Add to this, that his standing army of eighty thousand men is well disciplined and well provided, and that his fleet of eleven one hundred gun ships and as many frigates afloat, is in excellent order, while his dock-yard is large and richly stored—recollect the struggles of Mahomet Ali, first with the Mamaluke Beys, then with the prejudices of his own subjects, and lately with the Porte, and I think you will be surprised at the genius and enterprize of the man.

In strong contrast, however, with all this, is the condition of his subjects. This is most pitiable; I have no where seen so much abject misery. He makes them till every foot of cultivatable ground, takes from them the fruits of their labor and fills his granaries, allowing them only a bare sufficiency to live. The condition of a slave on one of our southern plantations is far better, in every respect. There are no schools, and indeed I could not hear of a single effort to raise or improve the condition of the people: every thing is of a contrary tendency, and with fine active forms and quick capacities, they are the most abject set of beings any where to be found. They hate the Pashas, both Mahomet Ali and Ibrahim, most cordially. Now really, this is not beginning reform in the right way—but I have not time to reason, I wish simply to give you facts. Mahomet Ali, however, does not fear his subjects. His army is effective and is strongly attached to him. When recruits are wanted, he sends his soldiers into the country, and a sufficient number is forced from their homes and driven down like so many beasts. At first, they pine and submit unwillingly to the discipline; but in a short time, they begin to like the new life, and soon after, have no other home than by their flag. The Pasha has three children living, but they are young, the older ones having been all carried off by the cholera. Ibrahim Pasha, who is the son of his favorite wife, but by a former husband, is to succeed him: this prince's ambition is all directed towards military affairs.

Mahomet Ali is about 67 years old, but bears his age very well. He is a little below the middle size, very stout, and to the sight unwieldy: but the eye is deceived, for his active mind allows little rest to the body. A rebellion broke out in Syria a fortnight since, caused by opposition from the natives to his conscription system: in a few days, he was among them, and he has already effectually put it down. His forehead is large and rough: his eye, always in motion and very keen, with a deep wrinkle running upward from the outer corner. The nose, what may be called beaked, mouth falling at the corners and garnished with a splendid white beard. The expression, when he smiles, is pleasant, but at other times, it makes a man feel as he would do when standing near an open barrel of gunpowder. His officers and attendants, however, are attached to him, and he is said to be fond of playing with his children. His mind seems to disdain attention to little things, for at our presentation, we found his audience room in the new palace at Alexandria, plainly ornamented, and the chandelier in the middle of it, with one of its branches broken off.

Coal Mine at Carnayl on Mount Lebanon.

Sept. 12.—In connexion with the improvements under the government of Mahomet Ali, it may be interesting to learn, that a bed of coal, has recently been discovered at Mount Lebanon, and that his agents, under the guidance of an English gentleman, of sufficient skill, are now exploring it with all the energy that the nature of that region of country will admit. It is about three miles north of the great road, leading from Beiroot to Damascus, and about eighteen miles from the former city. I intended, in a recent visit to Damascus, to turn aside and examine it, but was prevented by circumstances beyond my control, I learned, however, at Beiroot, that they have carried their investigations to a considerable extent, and I believe, with satisfactory results. In answer to my inquiries in one of the cotton manufactories at Cairo, they told me that trial of this coal had been made in their steam engine, but that, although it burnt well, it did not produce sufficient heat. This, however, was immediately after the mining had been commenced, and they hoped for better results, when the workmen should penetrate further into the bed. I have now some of the coal lying before me: it looks as well as any coal I have seen, and, on trial, I have found it burns readily and with a clear yellow flame: if an opportunity offers, I

will send you some of it, and will beg of you to give it a better trial.* The coal now used in the Mediterranean, I believe, is all brought from England, and should this turn out to be an extensive bed of good coal, the advantages to the neighboring regions will be immense. Cornayl is in quite an elevated situation, probably, four thousand feet above the sea, and, although the country between, is extremely rough, yet by following the windings of the ravine, on the edge of which, the mine is situated, a rail-road may be constructed at no very great expense: such a thing, I understand, is now in contemplation.

P. S. I have just seen a letter from Mr. Brattell, the agent at the mine. He says, it is situated, as far as he can judge, in Lat. 33° 56′ N. Lon. 35° 53′, and that the bed of coal is from three feet two inches, to three feet four inches in thickness, and that they are pushing their investigations above and below this spot. He thinks he has also discovered strong indications of coal on the eastern side of Mount Lebanon, and has little doubt that lead may be found on the same range. In digging for coal at Carnayl, they have brought a bed of iron ore to light: indeed, in asscending the western side of Lebanon, the oxides of iron ores mingle so largely with the native rocks, as to leave no doubt that this mineral may be procured in very large quantities.

ART. IV.—*Experiments with the Elementary Voltaic Battery*; by JAMES B. ROGERS, M. D. Professor of Chemistry, and JAMES GREEN, Philosophical Instrument Maker.

No subject of scientific investigation has produced more detailed observations, or excited a greater degree of philosophical curiosity, than Electricity. The past century has been most fruitful in discoveries connected with this subject, and it has now become one of great scientific value. The successive accumulation of facts, as collected by different observers, and the general laws which have been deduced from them, give to it an interest, which can be appreciated only by those who, devoted to similar pursuits, are enabled to estimate the importance, sometimes, of a great number of minute circumstances. It will, we think, be readily acknowledged,

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* It is the black bituminous coal, of a good quality.—*Ed.*

that a close attention to these circumstances becomes necessary in all experiments with the elementary voltaic battery. Entertaining this opinion, our attention was particularly directed to the phenomena displayed by different modifications of this arrangement, as detailed in Vol. xxvii. No. 1. of your valuable Journal; by the Messrs. W. and H. Rogers. Strongly impressed by the novelty of some of their observations, we determined to engage in a series of analogous experiments, modifying and extending them as the circumstanses seemed to suggest.

The galvanometer which we used throughout all our experiments, as a measure of electrical effect, was similar in every respect, to that described by the Messrs. Rogers, and the solution in which the plates were immersed consisted of sixty parts of water, and one of sulphuric acid, by weight.

1. The first observations .which we made, had reference to the relative importance of the two metals zinc and copper, in the galvanic element; and these closely corresponded with those made by the above named gentlemen.

In order to guard against any sources of error which might arise from the immersion of additional fresh surfaces at different depths, and also the moistened surfaces when successively withdrawn, we preferred using separate pieces of the requisite size, so as to admit of entire immersion, and the results were the following. The first column indicates the successive intervals of time, elapsing from the first moment of immersion of the plates, to that at which the angular deflection is observed.

Copper 4 sq. in. surface. Zinc 2 " "			Copper 2 sq. in. surface. Zinc 4 " "		
1′	50°	repeated after 5′ repose.	1′	33°	repeated after 5′ repose.
2′	45		2′	27	
3′	44		3′	24	
4′	41		4′	24	
1′	42°		1′	25°	
2′	38		2′	21	
3′	36		3′	20	
4′	35		4′	20	

2. It will here be seen that a much greater effect is produced by a large copper than a large zinc; but in order to compare these results with those obtained by Messrs. Rogers, with the use of slips immersed to different distances, we repeated their experiments, but in such a manner as to avoid the error arising from the constantly progressive decline, which followed successive immersions.

From what follows, it will be noticed that a real, though slight, augmentation of effect is produced by a considerable increase of zinc surface, the copper remaining constant.

Copper constant at 8 inches, Zinc dipped to

	1 in.	2 in.	3 in.	4 in.	5 in.
1′	28°	30°	32°	33°	34°
2′	27	29	31	32	33

These experiments were several times repeated, so that all the effects of decline, as arising from successive immersions, might be observed, and still we found an uniform increase of effect to arise from an enlarged zinc surface.

3. The relative quantities of the two metals were now varied, and the order of the observations alternated.

Copper constant at 3 inches, Zinc dipped to

	¼ in.	3 in.	8 in.	8 in.	3 in.	¼ in.	¼ in.	3 in.	8 in.	8 in.	3 in.	¼ in.
3′	9°	10°	11°	11°	10°	9°	8½°	9½°	10½°	10½°	9½°	8½°

4. We now returned to the use of plates, cut to a size, proper for entire immersion, as in the first experiments.

Copper constant at 3 sq. inches.

	zinc 2 sq. in.	z. 16.	z. 2.	z. 16.	z. 2.	z. 16.
3′	°	53°	62°	53°	66°	55°	67°

These results, which are selected from our record of similar ones, compel us to differ from the Messrs. Rogers, in thinking that an increase of effect is produced by a decrease of zinc surface.

5. In the next set of experiments which we prosecuted, we were desirous of determining whether the constant decline which we observed to accompany repeated immersions, had relation, most to the changes effected in the copper or zinc surfaces.

Copper and zinc, each 3 square inches, which had been previously used.

Copper and Zinc A.

		after 5′ interval.	again, after 5′
1.	70°	69°	60°
2.	68	64	58
3.	66	62	54

New copper with zinc A.		New zinc with copper A.	
1.	94°	1.	50°
2.	86	2.	50
3.	82	3.	47

The above zinc and copper, named new.

1′	46°
2′	44
3′	43

6. Similar experiments with another set of metals, that had also been used before.

Copper and Zinc B.

		after 5′ interval.
1.	65°	60°
2.	62	60
3.	60	57
4.	59	56

New zinc with copper B.		New copper with zinc B.	
1.	46°	1.	145°
2.	43	2.	100
3.	40	3.	93

Above copper and zinc, named new.

1′	90°
2′	87
3′	85

From these results, we think it is clearly shown that the decline is to be attributed principally to the copper. Indeed, in none of our experiments have we observed an increase of effect from substituting a *new* zinc in place of one that has been previously used, but on the contrary, as above, a sensible decline. But on the other hand, when a new copper was introduced, there was always a great increase of effect.

While engaged in these experiments, we discovered that metals of the same size, differed in the amount of their deflecting power, and accordingly we became desirous of ascertaining to what circumstance this might be attributed. As it could not escape notice that there existed a diversity of surface in plates, even if taken from the same mass, it occurred to us to try what effect would be produced by altering the surface mechanically, and by the action of chemical agents. The results now obtained were remarkably striking, and show in a very interesting manner the importance which belongs to the surface in the developement of Voltaic electricity. They also seem to teach us that the estimate which we had heretofore attached to new and clean metallic surfaces in voltaic plates arose from the want of a sufficiently minute attention to the circumstances under which the surfaces were contemplated, as well as in confining our observations too exclusively to the zinc.

7. The first experiments on what we may conventionally call the *character of surface*, were made with two zinc plates, which had been previously used.

Zinc No. 1. 85° permanent deflection.
" " 2. 84 " "

The surface of zinc No. 1. after being filed and brightly polished, gave 75° repeated 74° permanent deflection.

Zinc No. 2. after exposure 2′, to the action of a strong solution of sulphuric acid and water, gave

85° repeated 78°

It appears from these and other observations, which we have thought it unnecsssary to detail, that the deflectory power of the zinc is but little altered by changing the character of surface.

But the most interesting observations connected with this part of our subject, have relation to the changes induced in the *copper* surface. These we deem it proper to detail somewhat *in extenso*, for if corroborated by other experimenters, they are likely to exert an important influence upon the practical as well as theoretical considerations of voltaic electricity.

8. In the following experiments, we varied the relative proportions of zinc and copper so as to keep constantly in view the important point which engaged our attention in the commencement of this paper, viz. the greater importance which belonged to an increase of copper over a similar increase of zinc surface.

On character of surface.	Copper constant at 3 sq. inches.	
	zinc 2 in.	zinc 4 in.
No. 1 copper,	2′ 60°	2′ 58°
	3′ 58	3′ 57
	z. 2.	z. 4.
No. 2 copper,	2′ 55°	2′ 74°
	3′ 53	3′ 70

No. 1 copper was now immersed 5′ in a hot solution of nitric acid and water, and allowed 8′ exposure, without wiping, and gave

with	z. 2 in.	z. 4 in.		z. 2 in.	z. 4 in.
2′	177°	210°	Repeated. 2′	178°	200°
3′	177	208	3′	177	190
4′	175	206	4′	176	190

No 2 copper, immersed in a boiling solution of muriatic acid and water 5′ and allowed 8′ exposure without wiping, gave

	z. 2 in.
2′	404°
3′	395
4′	380
5′	350

In this experiment, at the close of the 5′, dark colored scales began to fall from the copper, and the decline was so rapid as to prevent any acurate observation of it; but after the scaling was completed and the newly exposed surface was gently washed with water, the same copper gave with z. 2 in.

2′	146°
3′	145
4′	144

A new copper immersed 2′ in same solution of boiling muriatic acid, and then gently rubbed and washed off with water, gave with

	z. 2 in.
2′	130°
3′	128

The same copper re-immersed, and dried by exposure for 7′ without wiping gave with

	z. 2 in.		z. 4 in
2′	175°	2′	170°
3′	166	3′	170

The same after eight hours repose, gave with

	z. 3 in.	z. 2 in.	z. 3 in.
2′	163°	140°	150°
3′	155	139	150
4′	155	139	150

No. 1 copper treated as before, with hot solution of nitric acid and water, and allowed eight hours repose without wiping, gave with

	z. 3 in.	z. 2 in.	z. 3 in.
2′	200°	134°	142°
3′	160	132	140
4′	150	130	138

9. In order thoroughly to test the correctness of the above observations, we repeated them with three entirely new coppers of 2 sq. in. surface, and zincs the same.

	No. 1 copper.	No. 2 copper.	No. 3 copper.
1′	49°	40°	41°
2′	45	32	39
3′	41	31	33

The same after exposure of 20′ to the action of a hot solution of nitric acid and water in equal parts and then washed with water, gave

	No. 1 copper.	No. 2 copper.	No. 3 copper.
1′	135°	135°	143°
2′	134	134	140
3′	134	134	140
4′	134	133	139

By reference to these tables, it will be noticed that the character of copper surface, as modified by various acid menstrua, is attended with an augmented deflecting power, and this varying with the acid used.

10. When the character of surface was altered mechanically by filing it bright, we obtained but a slight increase of effect.

Before filing.		After filing bright.	
1′	57°	1′	66°
2′	50	2′	65
3′	47	3′	65

11. *On the relation of distance.*—In the course of these experiments, we occasionally observed a variation in the deflecting power to arise whenever we altered the distance between the zinc and copper, and apprehending that this did not correspond in degree, with the law, as announced by Professors Cummings and Ritchie, viz. "That the deflection produced by a pair of plates, varies inversely as the square root of the distance between them; thus if a plate of zinc, be placed successively at 1, 4 and 9 inches from a plate of copper, the deflecting powers will be in the ratio of 3, 2, 1," we determined to submit the matter to experiment, and with plates of 8 square inches each, obtained at

½ in. distance apart.		2 in. distance.		
5′	65°	5′	57°	difference, 8°

With plates of 16 sqr. inches each,

½ in. dis. apart.		4½ dis.		
5′	125°	5′	95°	difference, 30°

Plates 4 sqr. inches,

½ in. dis. apart.		4½ dis.		
5′	80°	5′	60°	difference, 20°

Repeated.

½ in. dis.		4½ dis.		
5′	78°	5′	54°	difference, 24°
5′	75°	5′	55°	difference, 20°
5′	90°	5′	65°	difference, 25°

The amounts of deflection here shown, are widely different from what should have been expected in conformity with the law stated, which would have required a ratio of 3 to 2 in the numbers obtained in the first experiment, and of 1 to 3, in all those which follow. As far as our observations have extended the increase of effect produced by approximating the plates is so trifling as to render attention to it of little account in its practical application, although philosophically interesting.

12. *On the relative position of the metals.*—It now becomes an enquiry of some interest to ascertain experimentally the best possible relative position of the plates, to secure the greatest amount of electrical effect.

We accordingly varied the position of the metals to each other so as to present them parallel, at right angles, above or below each other, and in the same plane, edge to edge, and in all these positions we very unexpectedly found that the deflecting power was uniform, so long as the mean distance between the plates was preserved. Hence it appears that the ordinary method of arranging the metals in direct apposition, possesses no other advantage than that which may result from practical convenience, and in the facility of more closely approximating them.

In making this statement, we are not withont the hope that its novelty will elicit the attention of experimenters in some degree proportionate to the interest with which it has been regarded by us.

13. *On the deflecting power produced by different menstrua.*—Although it is a fact which has been repeatedly confirmed that the power of voltaic arrangements, is augmented by increasing the strength of the solution in which the plates are immersed; still as we are not aware of any detailed observations on the subject, we are induced to give the following. The relative proportions of acid and water given were estimated by weight, and the plates were constantly 4 sqr. inches each.

Sulphuric acid	1	water	60	permanent deflection,		60°
"	"	1	" 30	"	"	87
"	"	1	" 15	"	"	105
"	"	1	" 7½	"	"	135
"	"	1	" 3¾	"	"	164
Muriatic acid	1	water	60	permanent deflection,		70°
"	"	1	" 30	"	"	109
"	"	1	" 15	"	"	143

Muriatic acid	1	water	$7\frac{1}{2}$	permanent deflection,		177°
" "	1	"	$3\frac{3}{4}$	"	"	200
Nitric acid	1	water	60	"	"	84
" "	1	"	30	"	"	127
" "	1	"	15	"	"	174
" "	1	"	$7\frac{1}{2}$	"	"	295
" "	1	"	$3\frac{3}{4}$	"	"	467

14. We now used solutions, which were composed of $3\frac{3}{4}$ parts of water and 1 part of a mixture of two of the above acids in equal proportions. The observations were the following,

Sulphuric and nitric acid mixture,	1 water,	$3\frac{3}{4}$	permanent deflection,		380°
Nitric and muriatic acid, do.	1 "	$3\frac{3}{4}$	"	"	260°
Sulphuric and muriatic acid, do.	1 "	$3\frac{3}{4}$	"	"	207°
The three acids in the same proportion,	1 "	$3\frac{3}{4}$	"	"	200°

From these experiments, it will be seen that the increase of effect is greatly in favor of that acid solution which is known to be the most powerful in its chemical action on the *copper*, viz. the nitric acid; a similar increase of effect we found to belong to this acid, when we resorted to those copper plates, which had been treated with hot acid, as described in the experiments on character of surface.

The experiments thus detailed, might, under some circumstances, give rise to new generalizations respecting the developement of Voltaic Electricity; but as we are rather interested in behalf of the conviction, that accurate and definite records of phenomena, are still wanting on this subject, a conviction, which to us appears to be happily spreading among those devoted to the advancement of science, we are disposed, for the present, to leave them as recorded.

We may be permitted, before closing this paper, to state, that while engaged in the foregoing experiments, our attention was particularly directed to a notice contained in the last No. of your Journal, of some experiments made by the Abbé S. Dal Negro; from which he deduces the law that the effects of the voltaic element, are in the ratio of the perimeters of the plates; and in order to determine, for ourselves, the correctness of this inference, we made some experiments, from which, we have selected the following.

In the first place, we used rectangular slips of copper and zinc, ½ inch wide and 8 inches long, and squares of the same metals, of 2 inches side; each set containing a surface of 4 square inches; but their perimeters being in the ratio of 8 to 17. The deflections of the needle, were as follows:

			after 5′.	again.
With slips.	1′	70°	58°	52°
	2′	65	52	48
	3′	60	50	47
" squares.	1′	70°	70°	65°
	2′	70	65	62
	3′	68	60	60

Two smaller sets with surfaces of the same extent, but their perimeters in the ratio of 3 to 9, gave

slips.	1′	35°	32°	24°
	2′	32	30	22
	3′	30	28	21
squares.	1′	35°	32°	27°
	2′	32	30	27
	3′	32	30	25

From these experiments it would appear that while the surface remains the same, there is no augmentation of effect from increasing the extent of the perimeter.

ART. V.—*Researches on Wines and other Fermented Liquors*; by LEWIS C. BECK, M. D., Professor of Chemistry aud Botany in the University of the City of New York, &c. &c.

HAVING recently been engaged in a series of experiments to determine the proportion of alcohol contained in several kinds of wine and other fermented liquors, I was induced to examine some other points connected with their history; and now present for publication, in a condensed form, the results of my enquiries.

Composition of Wine.—The composition of wine is very variable. The substances found in it are, water, alcohol, undecomposed sugar, gum, extractive matter, vegetable albumen, acetic acid, bitartrate of potassa, tartrate of lime, tartrate of alumina and potassa, sulphate of potassa, chloride of sodium, and in the red wines, red coloring matter and in those of champaigne, carbonic acid.

Acetic and Carbonic Acids.—Acetic acid is often found in the wines from northern countries, and in altered wines it is formed at the expence of the alcohol. Almost all wines, however, exhibit the acid reaction. In champaigne, it is owing to free carbonic acid, but in others it is due to the bitartrate of potassa. The effervescence which is observed on adding carbonate of potassa to wine and the subsequent precipitation, are the results of the action of this excess of tartaric acid, and the consequent liberation of a portion of tartrate of lime which this salt most generally contains.

Malic Acid.—It has been frequently stated, that wine contains malic acid, and a malate of lime is said, by Chaptal, to be formed by the addition of lime water to wine ;—an opinion which seems also to be countenanced by Mr. Brande. But the existence of this acid is rendered doubtful, if not disproved, by the fact that an insoluble precipitate results, as well from the addition of ammonia or potassa, as of lime. Now the malates of these alkalies are very soluble, and hence we may more safely ascribe the precipitate thrown down in all these cases to the saturation of the excess of tartaric acid contained in the bitartrate of potassa, by which means the insoluble tartrate of lime, which is usually combined with it, is liberated.

Vegetable Albumen.—Grapes, according to Berzelius, contain a small portion of this substance, which he has described in the fifth volume of his elaborate treatise on chemistry. In examining a specimen of American wine, which was said to be the pure juice of the grape, I found, that when evaporated to about one eight of its bulk, upon adding a portion of alcohol, there was a deposit of a tough dark colored matter, soluble in water and in solution of ammonia, but insoluble in sulphuric acid. In these respects, it agrees very well with the description of vegetable albumen given by Berzelius. A portion of pure madeira when treated in the same manner, yielded a bulky white precipitate of saline matters.

Sulphate of Potassa.—The presence of sulphuric acid in wines is distinctly shown by the dense precipitate which results from the addition of muriate of barytes. I am not aware that any other ingredient would produce this effect, except carbonic acid, but the carbonate would be soluble in muriatic acid, which is not the case with the precipitate in question.

Tartrates of Potassa and of Lime.—The bitartrate of potassa is one of the most abundant of the solid ingredients of wine, and the tartrate of lime, as has already been remarked, is generally associated

with it. It is probably owing, in a great measure, to the presence of these salts, that such dense precipitates are produced upon adding to wine the acetate of lead, or the nitrates of tin, mercury or silver. Insoluble tartrates of the metallic oxides are thus formed.

Tartrate of Alumina and Potassa.—This salt, according to Berzelius, is especially characteristic of the German wines.

Coloring Matter.—In the light colored wines, the color is supposed to be derived from the extractive matter; but in the red wines there exist tannin and red coloring matter, the last of which, may be obtained, according to Robiquet, in a crystalline form.

Red wines are, sometimes, imitated by the dealers in wine, by adding to white wine other coloring matter; as for example Brazil wood, logwood, the red beet, elder berries, &c. The detection of these falsifications has engaged the attention of many chemists.

Vogel proposes the mixing of the suspected wine with the subacetate of lead. Pure wine gives, with this reagent, a greyish green precipitate; wine that has been colored by Brazil wood or elder berries gives a precipitate of an indigo blue color, and when the red beet or sandal wood has been employed, the precipitate is red.

The following are the results of my experiments with the subacetate of lead.

When added to pure Madeira wine, the precipitate was of a light yellow (cream) color.

Pure Port wine gave it, a greyish precipitate with a slight tint of green.

With infusion of logwood, the precipitate produced by the subacetate was of a deep purple; when the coloring matter was largely diluted with water, the precipitate was less dense and of a lead color.

With infusion of the red beet, the precipitate was of a puce color; when largely diluted, the precipitate was of a pale red (salmon) color.

In one of the wines which I examined, the subacetate of lead threw down a bulky purple precipitate, similar to that produced by its addition to infusion of logwood. I received this wine under the name of Torres Vedras. It was of a very dark color and was represented to be an old wine.

Berzelius states, that the coloring matter of red wines gives different colored precipitates with subacetate of lead, according to the age of the wine. Thus, in new red wine, the subacetate commonly throws down a blue precipitate; this circumstance must greatly impair the value of this test.

Nees D'Esenbeck has proposed a method of detecting artificial coloring matter in wine which is said to be more certain in its indications. This consists in dissolving one part of alum in eleven parts of water and one part of carbonate of potassa in eight parts of water. The wine is mixed with its own bulk of the solution of alum which renders its color more bright. To this, the alkaline solution is now added little by little, taking care not to precipitate the whole of the alumina. The alumina precipitates with the coloring matter of the wine in the form of a lake, whose shade of color varies with the nature of the coloring matter, and which, when combined with an excess of potash, assumes another tint also varying with the coloring matter combined with the alumina. In order to obtain correct results it is necessary to make comparative experiments with pure wine.—*See Berzelius' Traité de Chimie.*

Specific gravity of Wine.—It has long been known, that the specific gravity of wine gives us no information, as it does in the case of distilled liquors, of the proportion of alcohol which it contains. Direct experiments on this point have been made by Brisson and Brande. I, also, accurately determined the density of several varieties of wine and other fermented liquors. The following are some of the results.

Madeira, mean of three kinds, - -	0.98659
Sercial Madeira, - - - -	0.98606
London Particular, - - - -	0.98860
Port, mean of two kinds, - - -	0.98203
Sauterne, - - - - -	0.99511
Claret, mean of two kinds, - - -	0.99490
American Wine, - - - -	1.00702
Cider, mean of two kinds, - - -	1.03400
Metheglin, - - - - -	1.08964

Alcohol in Wine.—It has been a subject of some controversy, whether alcohol exists, *ready formed*, in wine, or whether it is generated by the heat employed in the process of distillation. The latter opinion was supported by Fabroni (*Ann. de Chim.* xxx, 220); but its fallacy has been completely exhibited, by the able investigations of Mr. Brande and Gay Lussac.

The following statements, seem to be conclusive, as to the existence of *ready formed* alcohol in wine.

1. Alcohol can be obtained from wine by distillation, *in vacuo*, at the temperature of 60° F., which precludes the idea, that it is

formed by the action of heat upon the elements existing in the fermented liquor.

2. When a portion of wine is partly distilled off, and the distilled liquor is afterwards added to the residuum in the retort, the specific gravity of the mixture, is precisely the same as that of the wine, previous to distillation. Alcohol being much lighter than wine, if it were formed during the process of distillation, would have the effect of reducing the specific gravity, when added to the residuum, which is never the case.

3. When the coloring and extractive matters in the wine, are precipitated by the subacetate of lead, the pure alcohol may be separated by the subsequent addition of dry subcarbonate of potassa, in the same manner as from whiskey, gin and brandy.

The first of the above statements, has been shown to be true, by Gay Lussac, (*Ann. de Chim.* lxxxvi, 175.) The correctness of the second, was demonstrated by Mr. Brande, upon a suggestion, contained in a notice, of his first paper published in the Edinburgh Review. I confirmed the results of Mr. Brande's experiments on this point, in the case of three kinds of wine, viz. Madeira, Torres Vedras and Claret.

The last, however, is the most conclusive of all the proofs in favor of this view of the constitution of wine, as by the process here referred to, the alcohol may be separated from wine without the intervention of heat. We are indebted to Mr. Brande, for having first pointed out a mode of effecting this object, (*Philosophical Transactions for* 1813.) This consists, in adding to the wine a solution of subacetate of lead, filtering the liquor and then adding to the filtered liquor, dry subcarbonate of potassa. The metallic oxide, as he says, forms a dense precipitate with the acid and coloring extractive matter of the wine; by filtration, a colorless fluid is obtained, from which, the alcohol may be separated, as above mentioned. Mr. Brande also states, that the acetate of lead and subnitrate of tin, produce the desired effect of separating the coloring and acid matters, in the greater number of instances; and to these, I may add, the protomuriate of tin, and the protonitrate of mercury, which I found to answer, in most cases.

Observing the effect of adding the subcarbonate of potassa to wine, viz. that of causing effervescence and the forming of a flocculent precipitate, I was led to infer, that the compound thus formed, interfered with the separation of the alcohol. To determine wheth-

er this opinion was correct, I added the subcarbonate to a portion of wine, as long as it produced the effect just mentioned, when the whole was thrown upon a filter. The filtered liquor was of a somewhat darker color than the wine, but when the subcarbonate was now added to it, the separation of the alcohol was speedily effected. This result was also produced, when I employed a solution of ammonia, instead of the carbonate of potash: the flocculent precipitate thus formed, being separated by filtration, the alcohol appeared as in the former case, upon the addition of a due proportion of subcarbonate of potassa. These experiments seem to prove, that the separation of alcohol in wine, by the common mode of adding subcarbonate of potassa, is prevented by the tartrate of lime which is liberated by the first addition of an alkali, and which, perhaps together with some of the other matters, forms a flocculent mass suspended in the liquor. In my opinion, they constitute a more decisive proof of the existence of *ready formed* alcohol in wine, than any which has yet been offered.

In the analysis of wines and other fermented liquors, the results of which are given below, the following process was adopted, for the purpose of determining the proportion of alcohol, which they contain. A glass bottle with a long and narrow neck, and capable of holding 1020 grains of distilled water, was filled with the wine under examination. This quantity of wine, was now put into a glass retort, which was carefully luted to a receiver, so as to prevent the escape of vapor. A gentle heat was applied to the retort, while the receiver, was kept constantly cold, by the dropping of water upon it. The heat being cautiously managed, towards the end of the process, I was enabled to distill off nearly, the whole of the wine, without burning the solid residuum. Thus, from 1008 grains of Madeira, I distilled over 979 grains, while from the Port, there was a loss of nearly 50 grains, in the same measure, owing chiefly, to the greater proportion of residuary matter. To make up for this loss, I added wine, of the same kind as that distilled, so as to bring it to the original measure of the wine, excepting a small allowance for the space, occupied by the solid ingredients. These were now shaken together, and allowed to remain for some time, and the specific gravity then carefully determined at the temperature of 60° F. From this, the proportions of alcohol and water *by weight*, were ascertained by a reference to the tables of Mr. Gilpin, published in the Philosophical Transactions for 1794, and by calculation, the proportions *by measure*, were estimated.

This process, it will be observed, is essentially that of Mr. Brande, and that my results may be easily compared with his, I have referred them, to the same standard, which he adopted. I may also state, that I compared these results, in one or two cases, with those produced by the process of precipitation, by subacetate of lead, and subsequent separation of the alcohol by subcarbonate of potassa. They were found to be so nearly coincident, that I did not think it worth while, to extend this mode of investigation.

Table showing the proportion of alcohol per cent, by measure, contained in several kinds of wine and other liquors; the specific gravity of the standard alcohol, being 0.825, *at the temperature of* 60° *F.*

Kind of Liquor.*	Proportion of alcohol per cent, by measure.	Kind of Liquor.	Proportion of alcohol per cent, by measure.
1. Madeira, common, - -	25.77	19. Port, - - - -	22.35
2. Do. imported from the house of Robert Seal,	23.11	20. Do. - - - -	21.98
		Average of 18, 19 and 20,	22.60
3. Do. common, - -	22.41	21. Torres Vedras, - -	20.51
4. Do. imported from the house of Houghton & Co.,	22.25	22. Sauterne, - - -	13.00
		23. Claret, Chateau Margeaux,	11.80
5. Do. "Farquhar," in bottle, 40 years old,	21.79	24. Do. Palmer Margeaux,	11.04
		Average of 23 and 24, -	11.42
6. Do. 20 years old, -	21.45	25. American Wine, 2 years old,	11.25
7. Do. "Edgar," - -	21.30	26. Metheglin, 20 years in bottle,	10.57
8. Do. "Brammin," -	20.91	27. Ale, Albany, in bottle 2 years,	10.67
9. Do. common, - -	20.72	28. Ale, Albany, in barrel, -	7.38
10. Do. "Wanderer," -	20.70	29. Cider, in bottle, - -	4.80
11. Do. "Blackburn," old,	20.68	30. Do. in barrel 6 months,	4.84
12. Do. said to be the pure juice of the grape, 28 years old,	19.30	31. Do. in barrel, - -	4.41
		Average of 29, 30 and 31,	4.68
		32. Irish Whiskey, imported in 1825,	73.70
13. Sercial Madeira, - -	25.18	33. Gin, genuine "Hollands,"	55.44
14. Do. Do. - -	18.96	34. Brandy, common, - -	51.01
Average of 14 kinds, -	21.75	35. Whiskey, common, - -	42.95
15. London Particular, - -	22.10	36. Spirits of wine, obtained at the Druggists,	93.27
16. Bucellas, - - -	18.80		
17. Brown Sherry, - -	18.03		
18. Port, 7 years in bottle, -	22.87	37. Spirits of wine, - -	95.35

The results in the above table agree generally with those of Mr. Brande. In all cases where the difference was marked, as in Nos. 13, 14, 22, 23 and 24, the trials were repeated several times, and

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* It is proper to state, that this investigation was commenced at the request of E C. Delavan, Esq., whose philanthropic exertions in the cause of temperance, are so well known, and so justly appreciated. From him and from other gentlemen, in the City of Albany, I received, with a few exceptions, all the specimens of wines and other liquors, which I examined. At my suggestion, each specimen was accompanied with a label, containing a notice of its reputed age and character; of which, I have introduced only so much in this table, as was necessary to identify and distinguish it. I should observe, that most of the wines are said to be among the purest and best, which are brought to this country.

the mean of these, is given. The Ale, No. 27, contains more alcohol, than any put down in the table of Mr. Brande, as ordinarily published; but in the Journal of Science and the Arts, (Vol. 5. p. 124.) he states, that Lincolnshire Ale, brewed by Sir Joseph Banks, contained 10.84 per cent. of alcohol. Our cider, it would seem, contains less alcohol than the lowest average of the specimens examined by Mr. Brande, which is 5.21 per cent.

Addition of Brandy to Wine.—An opinion has been recently advanced, that the large proportion of alcohol which some wines contain, is due to the addition of brandy to the *must*. And it has even been maintained, that, without such addition, wines speedily undergo the acetous fermentation, and thus, lose their peculiar flavors. These opinions, if correct, must render quite fallacious, the results of the analyses of the older wines, and they deserve, therefore, to be carefully examined.

In regard to this point, I avail myself, in part, of the information contained in the excellent treatise on Domestic Economy, by Mr. Donovan.—(*Lardner's Cabinet Cyclopædia.*)

Brandy is not added to wines in France or Germany: the finer wines, claret, burgundy and hock, are said to be totally destroyed by it. But the practice is quite common, nay, almost universal, in the wines of Spain, Portugal and Sicily, which are intended for foreign markets. The reason of this, I apprehend, is, not that the wines cannot be kept without such an admixture, but that these strong wines are in great repute, and perhaps, also, that with the addition of brandy, less care is required in preparing them for exportation.

That wines may be kept for a great number of years, without the admixture of brandy, is evident, from the age of many ancient wines. Horace speaks of wine, that is nearly seventy years old; and the Opimian wine, which had been made in the time of the consul Opimius, was two hundred years old. "In order to preserve their wines to these ages, the Romans concentrated the *must*, or grape juice, of which they were made, by evaporation, either spontaneously, in the air, or over a fire, and, so much so, as to render them thick and syrupy."

This process of evaporation, however, was by no means, necessary to their being preserved; for wines, not treated in this manner, have been known to keep equally long. We are informed by Neuman, "that the tartish German wines, keep the longest of any:

some of them have kept two hundred or three hundred years; and in Strasburg, there is a cask four hundred years old, and many, above seventy; the wine being occasionally racked off into smaller casks, that the vessel may be continually full. These very old wines, are preserved, rather for curiosity than use, as they not only grow too strong for drinking, but at last, quite disagreeable."

The preservation of wines for so long a time, when the process of distillation was still unknown, and in cases where no brandy had been added, as in the German wines, referred to by Neuman, seems to prove conclusively, that the admixture of brandy, or other distilled liquor, is not necessary to effect this object.

Nor is it probable, that the strength of the wine is much influenced by the brandy, as ordinarily employed. The pure juice of the grape, after a few years, becomes fully as alcoholic, as those wines which have been brandied. Mr. Brande procured port wine, sent from Portugal, for the express purpose of ascertaining how long it would remain sound, without any addition whatever, of spirit, having been made to it, but it did not differ, materially, in the proportion of alcohol, from other kinds. Moreover the raisin wine, which had been fermented without any addition of spirit, contained a larger amount of alcohol than any other wine in his tables.

As the alcohol in natural wines, is the produce of the sugar contained in the grape, if any part of the sugar escapes decomposition, the wine will contain alcohol, and unaltered sugar, and will be *sweet*. Now, in those grapes, which contain a large proportion of sugar, and in which, there is a sufficiency of yeast present, to decompose it, there will be a superabundance of alcohol. But, the alcohol thus formed, stops the fermentation, and the same effect is also produced by the admixture of brandy or spirit.

On the contrary, where the relative quantities of yeast, sugar and water, are such as will conduce to a perfect attenuation, the fermentation will proceed until the whole of the sugar is converted into alcohol. The result, under such circumstances, will be a full bodied, spirituous, sound, and as it is technically termed, a *dry* wine.

The addition of alcohol, during the fermentation of the must, therefore, is to be conducted upon fixed principles and with a strict reference to the deficiences in the ingredients of the grape. An indiscriminate admixture of spirit, either during the fermentation, or after that process has ceased, would be attended with hazard to the flavor and value of the wine.

It follows, from these remarks, that alcohol is generated during the process of fermentation, and that its amount depends upon the proportion of saccharine matter in the grapes, and that, when all the ingredients are in due proportion, the most sound and spirituous wines are obtained. That, when this is the case, the wine may be preserved for any length of time, without the addition of spirit in any form. And that when this addition is made, it is only for the purpose of supplying deficiencies in the must, or in other words, to bring the wine to that degree of strength, which it would naturally have attained, if all the ingredients of the must, had been in such proportion as to effect a perfect attenuation.

Wines of Palestine.—In the discussions which have recently taken place concerning the chemical nature and effects of wines, some opinions have been advanced, concerning the wines of Palestine, which deserve a little consideration. It has been supposed, that the wine spoken of in various parts of sacred history, was far less spirituous than that of modern times; and some have even gone so far as to assert, that *all* modern wines are *brandied*, and that, to this circumstance, is to be ascribed the large proportion of alcohol, which they are found to contain. Upon consulting the original papers of Mr. Brande, however, it will be found, that that acute chemist was not ignorant of the fact, that many wines are artificially brandied; and as the very object of his researches, was to prove the existence of ready formed alcohol in natural wines, he would, of course, be careful to select those which were free from admixture. Indeed, he expressly states, that he used this necessary precaution; and moreover, Gay Lussac, though in the very country where many of the wines analyzed by Mr. Brande were produced, confirms and quotes his results, without expressing the least doubt of their accuracy from this cause.

It is, therefore, probable that in most of the wines which were examined by Mr. Brande and by myself, the whole amount of alcohol was due to the fermentation of the *must*. The differences in this amount, depended upon the kind of grape and upon the influence of climate, soil and culture. These facts being assumed, we shall have some guide in our subsequent enquiries.

The wines of Palestine, are generally represented by modern travellers, as being of excellent quality. The sweet wines are, particularly esteemed in the east, because they are grateful to the taste, very exhilarating, and will keep some of them for a long time. They

were, therefore, preferred by those addicted to drinking, and commonly selected for the tables of Kings, *(Paxton's Illustrations.)* The prophet Joel, accordingly, describes a state of great prosperity, by the figure of mountains, dropping down new, or more correctly, *sweet* wine, (c. III, v. 18.) Their inebriating quality, is alluded to by the prophet Isaiah. "I will feed them that oppress thee, with their own flesh; and they shall be drunken with their own blood, as with sweet wine," (c. 49, v. 26.) And the privation of this enjoyment, is placed by the prophet Micah, among the judgments, which the Almighty threatened to bring upon his ancient people for their iniquity. "Thou shalt tread the vintage of sweet wine, but shalt not drink wine," (c. 6, v. 16.)

Thus the testimony of travellers, concerning the spirituous nature of the wines of Palestine, accords with that of the sacred writers. The ancient wines are said to have been mixed with water, for common use; but it is evident, that this practice did not prevail among the Jews, for Isaiah, in mentioning a mixture of wine and water, evidently means to express, by the phrase, the degenerate state of his nation. "Thy silver is become dross, thy wine mixed with water," (c. 1, v. 22.) It is observed, by Thevenot, that the people of the Levant, never mingle water with their wine at meals, but drink by itself, what water they think proper, for abating its strength. While the Greeks and Romans, by mixed wine, understood wine united and lowered with water, the Hebrews, on the contrary, meant by it, wine made stronger and more inebriating, by the addition of powerful ingredients, as honey, spices, &c.; or wine inspissated by boiling it down to two thirds or one half of the quantity, myrrh, opiates, and other strong drugs being added, *(Paxton's Illustrations.)* And severe denunciations against the use of this drink, are contained in various parts of the sacred scriptures.

Moreover, the grapes of Palestine, were remarkable for their size and richness. The account given by Moses of the bunch of grapes, brought by the spies, to the Israelitish Camp, (*Numbers* xiii, 24,) is confirmed by the statements of several travellers. Doubdan assures us, that in the valley of Eshcol, were bunches of grapes, of ten or twelve pounds. Forster tells us, that he was informed, by a Religious, who had lived many years in Palestine, that there were bunches of grapes, in the valley of Hebron so large, that two men could scarcely carry one, *(Calmet's Dictionary.)* Indeed, travellers, generally concur in their high commendation of the grapes of that country.

To these facts I will only add, that the wines of Palestine were generally kept in bottles made of leather or goat skins firmly sewed or pitched together. In these the process of fermentation took place, and the wine acquired its proper degree of strength.

In the absence of any thing like chemical analysis, these are the data, from which we must draw our conclusions concerning the nature of the wines referred to by the sacred writers. Some of them are represented to have been sweet wines, which if not the strongest, are known to be among the stronger kinds. The grapes from which they were produced, were remarkable for their richness and excellence, the climate of the country being such as to favor their growth and the development of those principles, which during fermentation are converted into alcohol. And as the grapes of that country are now known to furnish very rich and spirituous wines, we may infer that the ancient wines were similar in their character, since there is abundant evidence, that the climate has not suffered any material change, for three thousand years.

I should not omit, in confirmation of this view of the spirituous nature of the wines of Palestine, to advert to the modes in which they were kept. It is now well known, that when mixtures of alcohol and water, are put into bladders, the water evaporates and leaves the alcohol in a more concentrated form. And it is asserted, that wine which has been kept in bottles, closed by pieces of bladder firmly tied over the mouth, in a few weeks acquires the strength and flavor which would be imparted to it only by several years preservation, in the ordinary way. Now it is probable, that the leathern bags, into which these wines were put, would produce a similar effect upon the liquor, which, after the process of fermentation had ceased, would soon attain its complete and appropriate alcoholic character.

Intoxicating power of Wine.—It is generally supposed, that in wine, the action of the alcohol upon the animal economy, is modified by the other vegetable matters, which are mixed or combined with it. According to this view, it is of course taken for granted, that the intoxicating power of wine is not so great, as that of a mere mixture of the same proportion of alcohol with water. Before offering any remarks upon this point, it may be proper to introduce the following table, showing the relative powers of several wines and other fermented liquors, on the supposition, that the alcohol is equally effective, as in distilled liquors :—brandy containing 53.39 per cent

of alcohol, being taken as the standard, and set down as one hundred.

Brandy, - -	100.	Sauterne, (22) -	24.34
Strongest Madeira, (1)	48.26	Claret, (average) -	21 38
Weakest Madeira, (6)	36.14	American Wine, (25)	21.07
Port, (average) -	42.33	Metheglin, (26) -	19.79
Bucellas, (16) -	35.21	Ale, (27) - -	19.98
Sherry, (17) -	33.75	Ale, (28) - -	13.82
Torres Vedras, (21)	38.22	Cider, (average) -	8.76

From this table it appears that two measures of strong Madeira are equivalent in the amount of alcohol which they contain, to nearly one measure of brandy, and that about five measures of ale are equivalent to about one of brandy. It will perhaps be quite generally asserted that the intoxicating powers of these liquors are not in the proportions thus expressed; and hence the opinion that the effect of alcohol in wines and other fermented liquors is modified by the other vegetable matters which they contain. I apprehend, however, that the difference is not so great, all things being equal, as might at first be supposed. The following facts appear to me to throw some light on this subject.

New wine is said to be more intoxicating than that which is old, although the latter is usually more spirituous. The reason of this undoubtedly is that the alcohol by time becomes more intimately combined with the water and thus to a certain extent loses its power of intoxication. The union of alcohol and water is not complete until they have been for some time in contact, and hence when brandy and water are taken into the stomach immediately after their mixture, the effect on the system is not very different from that produced by the same proportion of brandy taken separately.

Mr. Brande, in one of his papers, assures us, that when brandy and water are mixed and allowed to remain in combination for some time, the intoxicating power is not greater than that of wine containing an equivalent of brandy. In wines, the union of the alcohol and water becomes complete by the process of attenuation, and it is in my opinion to this more than to the controling effects of the other vegetable matters, that we are to ascribe their less decided intoxicating powers. And on the contrary, it is to the imperfect union that the ordinary mixtures of brandy and water owe their more energetic action on the system.

I should also observe, that mistakes concerning the relative intoxicating powers of mixtures of alcohol and water and of wines, may have arisen from the different modes in which they are ordinarily drank. A half pint glass of brandy and water of common strength contains an amount of alcohol but little less than the same measure of ordinary Madeira. And if these portions of wine and of brandy and water should be drank in the same manner, the effects on the animal economy would not be so different as is generally supposed. Wine is usually taken in small quantities and at intervals ;—circumstances which must have a great effect in modifying its action on the system : and to these may also be added the fact that its habitual use impairs the susceptibility of the system to its intoxicating power.

On the whole then there is reason to conclude that the difference in the intoxicating power of wine and that of the ordinary mixtures of water with the same proportion of alcohol, if it exists at all, is owing more to the intimate combination of the alcohol with the water in the former, than to any peculiar effect of the other vegetable matters contained in it. But, from the considerations above stated, I am inclined to believe, that, after all, the difference is rather apparent, than real.

ART. VI.—*Notice of the Meetings of the British Association for the advancement of Science, in* 1833, *at Cambridge, and in* 1834, *at Edinburgh; in two parts.*

PART I.—*Notes extracted from a Tour in England, during the months of June and July,* 1833; *by* Mr. QUETELET, *of Brussels.* Translated for this Journal, by a pupil of Prof. Jos. Henry, of the College of Nassau Hall, Princeton, New Jersey, and communicated by that gentleman.

General meeting of the English Philosophers at Cambridge.—The British Association for the advancement of Science, was instituted at York, and the first meeting took place in 1831. The one which succeeded this, was held at Oxford, and in its results far surpassed all the expectations of the founders of the institution. The third meeting, just held at Cambridge, has been perhaps even more celebrated, and will certainly form an epoch in the annals of science

in England.* This meeting commenced the twenty fourth of June, and continued during a week. About twelve hundred persons were present, and among them were most of the distinguished English philosophers. There were very few strangers, and this circumstance was probably owing to the anniversary of the meeting not being late enough in the season to permit the greater part of the Continental philosophers, and especially the professors of the universities to join in its proceedings; no doubt the number will be rendered much more considerable the next year at Edinburgh, by fixing, as has been done, the anniversary about the beginning of September.

Admission to the association was subject to very few restrictions. Any one who has communicated to a scientific society, any investigation printed among the proceedings of this society, and also persons sent as delegates from provincial scientific societies, could take a part in the proceedings, after having subscribed to the rules of the association.

The entering of the names took place under the superintendence of a committee. The price of admission for members being one pound sterling.

Learned strangers, introduced by some member of the association were admitted gratuitously.

The meetings were *general* or *special.*

The *general meetings* were held in the academical senate chamber. Questions of a general interest were there discussed, and there were made, summary reports of the proceedings of the sections, elaborate reports upon the progress of certain branches of science, which had been requested the previous year from gentlemen versed in these sciences, etc.

Special meetings, or *sections*, had been arranged according to the nature of the science, and were held simultaneously in different places. There were five of these sections, and during the meeting, a sixth was formed of which I shall soon have occasion to speak.

These five sections were arranged in the following manner:

First section,—Of mathematics and physico-mathematics (astronomy, mechanics, hydrostatics, hydraulics, light, heat, sound, meteorology and the mechanical arts.)

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* Prof. SEDGWICK, a distinguished geologist, presided at this meeting; the vice-presidents were MESSRS. AIRY and DALTON; the secretaries MESSRS. HENSLOW and WHEWELL. The late president was the well known geologist BUCKLAND; and the president for the next year is Admiral BRISBANE, the founder of the observatory erected in New Holland.

Second section.—Of chemistry, electricity, galvanism, magnetism, mineralogy, chemical arts, and manufactures.

Third section.—Of geology and geography.

Fourth section.—Of natural history, (botany, zoology, and vegetable physiology.)

Fifth section.—Of animal physiology, anatomy and medicine.

Each section could be divided or be united to another; it had also the right of choosing a president, vice president and two secretaries. These secretaries were charged with the collection of the papers and documents necessary to the secretaries of the association in making out their general report.

During the meeting of the sections, special communications were made, and announcements, either written or oral of recent discoveries, of researches, of the results of researches, of experimental solutions of doubtful questions, indication of points important to be examined, notices of the progress of science in other countries and oral remarks on these communications.

It would be impossible for me to give a complete account of all the proceedings of the general meetings or of the sections; neither time nor the nature of my studies would permit my following out so many different communications. To have an idea of their importance, it is sufficient to glance at the volume containing the reports of the British Association held last year at Oxford.* We there find, besides the most instructive and varied communications, reports full of interest, upon the history and recent progress of particular branches of science. Reports of this nature were read this year and particularly on the following subjects:

On the state of knowledge relative to terrestrial magnetism by Professor Christie.

On the actual state of the analytical theory of hydrostatics and hydrodynamics, by Mr. Challes.

On the state of knowledge relative to hydraulics considered as a branch of engineering, by Mr. G. Rennie.

†On the state of knowledge, relative to the strength of materials by Barlow.

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* Reports of the British Association etc. 1831—1832, 1 vol. 8vo. 624 pages. London, published by John Murray, 1833.

† Mr. Barlow who was prevented by indisposition from assisting at the meeting sent his report together with a fragment of a beam, which in breaking, had shown in its fracture some circumstances quite unusual.

On the state of knowledge, relative to mineral veins by John Taylor.

Though it is impossible for me to give a complete account of the labors of the English philosophers at Cambridge, I will endeavor to give, at least, a sketch of some subjects which received attention from the section of physical science, in which I was more directly engaged. It will serve to give a more correct idea of the manner of proceeding.

The secretary of this committee was Mr. Forbes; the president Mr. Peacock, whose efforts united to those of Messrs. Herschel, Babbage, and Whewell have contributed more to disseminate in England the modern system of notation, and the new analytical methods.

Aurora Borealis, Shooting Stars.—The first sitting was devoted almost entirely to descriptions of the aurora borealis, and to interesting remarks on these brilliant meteors, made by Messrs. Dalton, Airy, Potter, Scoresby, Robinson, etc., in succession. They endeavored to determine the circumstances which should receive the most attention from observers during the phenomenon, and a very animated discussion accidentally arose on the subject of the rustling, which according to some observers very often accompanies the appearance of the aurora borealis. Mr. Scoresby whose voyages in the polar regions are well known, was convinced that this rustling is a mere illusion; other persons, present at the meeting, declared on the contrary that they had heard it very distinctly.

This animated discussion, sustained by men so highly distinguished, and in a country where the aurora borealis so frequently appears, became more interesting, as it was in a measure a recapitulation of the state of knowledge respecting these meteors. It naturally led to the conclusion, that new observations were necessary, and that they should be multiplied as much as possible, in order to determine with precision all the circumstances of the phenomenon. It is remarkable that the number of appearances of the aurora borealis, has very sensibly diminished in our climate: the abbé Chevalier and the abbé Mann, who made meteorological observations at Brussels for the Palatine society of Manheim, fifty years ago, mention twenty four during a year, while we now observe but one or two during the same period.

There was also a discussion on shooting stars, another phenomenon not less interesting and perhaps less studied than the preceding, although it is seen much more frequently. This subject was also spoken of during a second meeting. The numerous researches that I had made, with respect to these meteors, to determine their

height, the velocity of their motion, etc.,* enabled me to join in the novel discussion, and to call the attention of the observers to its importance. Mr. Herschel strongly supported the opinion, that the study of these meteors might be very useful, particularly in the determination of the longitude. Mr. Robinson, director of the observatory at Armagh, mentioned that he had already successfully availed himself of this method of observation.

A large part of the second meeting, was devoted to a subject of not less importance, especially in England; it was the question of the most advantageous form for vessels: this subject gave rise to a very varied discussion, in which Messrs. Lardner, Challis, Robinson, Bailly, etc., joined. Some gentlemen spoke particularly of the inadequacy of our analysis in the present state of the science, to produce a solution of so complex a problem.

Optics.—Optics occupied a large part of the next meeting, and we had the pleasure of hearing Messrs. Herschel, Brewster, Lloyd, Airy, Hamilton, Powell, Potter, &c., on this important subject. From the politeness of these gentlemen, and owing to the communications, they were so good as to impart to me, I was enabled to profit by their researches, in preparing the notes which will be joined to the translation of Mr. Herschel's treatise on light.

Mr. Potter commenced by giving the results, to which he was led by his investigations on the intensity of light reflected from the surface of bodies. This philosopher has deduced from his observations, that when the reflection is from the surface of metals, and we take the sine of the angle of incidence of one hundred rays for the abscissa of a system of rectangular coordinates, the ordinate representing the reflected rays, is that of a *straight line*. Thus in the equation, $y=ax+b$, for a metallic mirror, y is the reflected light, a the trigonometrical tangent of $355^\circ\ 12'$ $b=72.3$ and x is the sine of the angle of incidence of 100 rays. When the reflection is from transparent bodies, the preceding equation becomes that of an *hyperbola*, and takes this form: $y=a+\frac{c}{r+b-x}$; a, b, and c are the constants which we

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* I was so fortunate as to converse with the illustrious *Laplace*, a few years before his death, on these investigations. This great philosopher remarked, "We can assign the movements of the planets through space, we calculate the orbits of the comets, we determine after a short appearance their return, which only occurs at very distant intervals, and yet we have no precise idea of the nature of these meteors, which are constantly reappearing, and are only a few leagues distant."

Mr. Brandes is now repeating in Germany, the observations which he has already made upon these meteors.

ascertain by experiment, and $r=100$. The communication, made by Mr. Potter at Cambridge, had for its object particularly to show the coincidence between the results calculated by the formula, and those furnished by experiments with the glass of antimony.

In discussing the importance of these observations, we were accidentally led to speak of the new photometer invented by the author, Mr. Ritchie, whose photometer is well known, made some very interesting remarks on the organ of sight,* and upon the mistakes to which it is liable.

Mr. Herschel read a paper on the absorption of light, of which he promised me an extract. He also repeated with the greatest success, an experiment on the interferences of sonorous rays, mentioned in his article on acoustics in the *Encyclopædia Metropolitana*, and which consisted in vibrating two *diapasons*, perfectly in unison above a glass vessel about eight inches in height, and less than two inches in diameter: a little water was at the bottom of the glass; the *diapasons* successively vibrating above the glass, gave a continuous sound, and when they vibrated simultaneously, we heard very rapid and very distinct intermissions of sound.

Mr. Hamilton showed the principal results respecting conical refraction, to which he has been led by his ingenious views and his elegant analysis; and Professor Lloyd mentioned the result of some of his observations which fully confirmed what Mr. Hamilton had discovered by his formulas.

At a special meeting which I attended with Messrs. Herschel, Brewster, Powell, Christie, etc., Mr. Wheatstone showed a very ingenious experiment; its object was to determine whether the appearance of a light is instantaneous, or has an appreciable duration, and if so to measure this duration. For example, he endeavored to ascertain if an electric spark has an appreciable duration. To determine this, Mr. Wheatstone took a circle of paste board, which he divided into several sectors alternately white and black; he then caused the circle to revolve in its own plane around a fixed axis, and the result was that by this rotation the surface of the circle appeared grayish, on account of the duration of the impression of light

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* I recollect when at Mr. Gartner's, whose establishment at London is so well known to geographers, that I found him engaged in showing some persons present, that the hand is endowed with more sensibility than the eye. His demonstration consisted in tracing, by his hand and with a simple rule, lines, so near together and so fine, that the eye could not distinguish nor count them but by means of a magnifying glass.

upon the retina. This determined, if the circle is put in motion in a perfectly dark chamber, which is suddenly illuminated by an electric spark or by a discharge from a Leyden jar, we shall see, very distinctly, the black and white sectors as if the circle were in a state of perfect rest, notwithstanding the rapidity of rotation which may be given it. We must then conclude that the circle has been enlightened only during an instant infinitely short. Yet the image on the retina is so vivid and continuous as to render the image of the circle very distinct. We must suppose that if an electric spark had an appreciable duration, we should see the revolving circle in several successive positions, and it would be impossible clearly to distinguish its image.*

The nature of these investigations, which depend on the duration of sight, gave me an opportunity to speak of Mr. Plateau's researches in Belgium, who, in following out the very curious researches of Messrs. Roget and Faraday, has made a very ingenious little instrument which he calls a phantascope, and which has been since imitated in France in a very imperfect manner, under the name of phenakistiscope, and in London under that of phantasmascope.

Magnetism.—Magnetism was not neglected, the desire was expressed of seeing observations on the inclination and intensity of the magnetic needle multiplied, as they are unfortunately still very rare. Mr. Christie of Woolwich showed very clearly the importance of corrections, and especially of those with reference to the inequality of temperature, a subject with which he has been recently occupied. There was also a discussion on the inequality of the magnetic force, which Mr. Kuppfer thinks he has observed between the summit and base of mountains, contrary to previous observations, and which I have had an opportunity of verifying in the Alps, with Mr. Necker Saussure, who had the goodness to take a part with me; and which Professor Forbes has since equally confirmed, but of which the results have not as yet been published. Researches of this kind were especially recommended to the attention of observers. I believe it will not be less interesting to verify a remarkable result which Mr. Necker has deduced from my observations; it is that the mag-

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* Prof. Joseph Henry, of Princeton, N. J., repeated the interesting experiment mentioned above, on the instantaneous illumination of an object by an electric spark. The effect is most easily shown by the common philosophical toy called the phenakistoscope. If one of the discs of this instrument be put in rapid motion, and then illuminated by a discharge from a Leyden jar, it will appear to be at rest with the picture on it distinctly visible.

netic intensity presents scarcely any anomalies when observations are made on extinguished volcanoes; while the contrary is extremely sensible on volcanoes in action; from this it would seem that these anomalies depend upon chemical actions.

I availed myself of my journey in England, to confirm the observations on the relative intensity of magnetic forces at Paris, London, and Brussels, which Capt. Sabine was so good as to communicate to me. I believe that Prof. Forbes has repeated the same observations on his part, which will give a valuable source of correction. Mr. Snow Harris, intends to determine the difference of intensity between Cambridge, London, and Plymouth.

Mr. Snow Harris, (whose very ingenious magnetical and electrical apparatus I regret that I cannot here describe,) in order to ascertain the horizontal state of the needle, (for intensity,) suspends it over a liquid and endeavors to produce parallelism between the needle and its image.

The doubtful question was also discussed of the degree of precision which may be obtained by magnetic instruments; some of the gentlemen, for instance, doubted whether the dip could be obtained nearer than one fourth of a degree, others mentioned observers who thought they could obtain it within half a minute. It is not uninteresting to know the limits of precision in the opinion of philosophers, as it gives us a standard of the actual condition of the science, and of the mechanic arts. Mr. Scoresby exhibited a variation compass, with a number of circles, designed to supersede, in many cases, astronomical instruments in determining the elements of situations at sea. Admiral Brisbane agreed with him as to the advantages offered by this instrument.

This naturally leads me to speak of the globe, which Mr. Barlow was so good as to show me at Woolwich, and upon which this philosopher had traced lines, showing the places which gave the same variation of the needle, according to the latest observations. The coasts appeared to have a very marked influence on the deflections; I was struck the next day with seeing at Mr. Bailly's that the result of the observations, on the pendulum left by Capt. Forster, which have just been calculated afford almost the same discrepancies.

Mr. Bailly, who was so obliging as to show me Capt. Forster's papers pointed out to me a very curious result, which is in fact confirmed by very few observations, but which, on that very account, deserves to be further verified; it is that the oscillations of a pendu-

lum in the plane of the magnetic meridian, and perpendicularly to this plane, do not give the same values.

I cannot forbear mentioning a fact sufficiently curious, which I observed in London at Mr. Watkins, and which Mr. Christie has confirmed by his own experiments; it is that pieces of very soft iron, after having acquired magnetism by induction, preserved all their force during a fortnight, and others even a month, after being subjected to a current of electricity, but when separated from the armature, their power almost entirely disappeared. I had an opportunity to speak of it to Mr. Christie without finding any plausible explanation. I now regret that I did not carefully examine the places of contact, and observe, whether the surfaces brought together and united at first by magnetic force, might not afterwards remain so in the same way as the Magdeburg hemispheres.

Magnetical observations were recommended to be made, during the appearance of the aurora borealis, and it was also requested that they should be made, as far as practicable, during all meteorological observations. Without denying the great advantages to be derived from observations taken with this view, I think much more might be gained from observations on the nature and intensity of atmospheric electricity, which I regard as one of the most important subjects of examination; this was also the opinion of Mr. Herschel. I have since seen at Paris the apparatus designed by M. Arago for this purpose, and with which he has made observations with an accuracy which will no doubt effect new discoveries for science.

Mr. Brunel, in a special communication, gave the details of the observations made by himself and Mr. Faraday, on the employment of the expansive force of liquid carbonic acid; observations which are still but too little known by those who endeavor to employ this substance in machinery instead of steam. These experiments, which were made with great care, prove that the carbonic acid gradually loses its elastic force. Mr. Brunel was so good as to show me, at London, the designs of the apparatus of which he has availed himself.

Tides.—It had been recommended, last year, that attention should be devoted to the subject of tides. Mr. Whewell, who has just published, in the Philosophical Transactions of London, a very interesting memoir on this subject, and which has also received much attention from Mr. Lubbock, read an interesting report, in which he recapitulated all that has been achieved by science up to the present time.

It would be very advantageous to collect the observations on the tides which have, no doubt, been made at Antwerp and Ostend, and communicate them to the English philosophers, who have expressed a desire to be acquainted with them. If those among us who really desire the advancement of science, would agree to take part in the observations which are now making in many places on the same plan, I would cheerfully impart all the instructions communicated to me on this subject, and those especially by Mr. Whewell, whose duty it is to collect all the documents to be brought before the Association.

The amount of the annual subscription of the members, although trifling, has produced a considerable sum since the commencement of the Association; and it has been resolved to appropriate it to the encouragement of difficult but useful labors, such as observations on the tides, reducing the calculations of ancient astronomical observations not yet published, &c. They have also offered a premium for a collection of constants according to the idea of Mr. Babbage.

Babbage's Calculating Machine and Constants.—This philosopher has for a long time expressed a wish to see a kind of repertory formed, in which all that can be measured should be recorded; for instance, the specific gravity of bodies, the linear dilatation of metals, the size of animals, that of their bones, their weight, quantity of air required for one inspiration, &c. A grand design, especially if they record the age of living beings, as I have endeavored to do for the human race. The plan that I have made out for man alone, is so extensive that I have no hope, even with the assistance of many of my friends, of being able to bring forward more than a mere outline of the great work that I contemplate. I think, however, we should not give up any investigations, however extensive, from which any advantage may be derived. Time is an agent which will accomplish the most laborious undertakings, and if our endeavors are directed in the proper channel, posterity will finish what we have not been able to complete.

Mr. Babbage, who does not shrink from the most gigantic undertakings, is the inventor of the celebrated calculating machine, commenced some years ago, at considerable expense, but which he will probably never see finished on the immense plan he has conceived. The machine, however, in its present state, does its duty readily and enables us to understand the plan of the inventor. Owing to the intimacy which I have enjoyed for a long time with Mr. Babbage, I had an opportunity of inspecting all the details of the ma-

chine, and was enabled to form a far more correct idea of a work which I have often heard mentioned, but with the details of which very few persons are acquainted. It is certainly very complicated, and great attention is necessary to follow the action of its different parts, so that I will not attempt to give a description, which would no doubt fill a large volume, if we paid any regard to the ideas of the inventor, the minute perfection of the workmanship, and all the mathematical calculations which can be performed by this machine. In 1829 a committee of engineers, of whom Messrs. Brunel, Donkin, Bartow, &c. were members, thought this work the most perfect they had ever seen. One of its most useful applications would be the construction of logarithmic tables, especially with the improvements designed by Mr. Babbage. The machine will print logarithms while it calculates them, so that the least error in the copy or the printed part can be detected. It may, it is true, happen that when in motion one tooth of a wheel may break, and a mistake in this way be committed, but as this mistake would be carried out in all the subsequent results, it could not escape observation on proving the final result.

Statistics.—Statistical information has not less engaged Mr. Babbage's attention, and as this science is not included in the number of those which the committees at Cambridge were appointed to examine, we united with Messrs. Malthus and Jones, with whom I have the pleasure of being acquainted, to discuss the subject. Some individuals showed a desire to be present at these meetings, which were at first altogether private; they soon, however, received a share of attention from the society, at the general meeting, by appointing a committee for statistics, but confining its operations to the numerical part of the science. Mr. Malthus was intended for the president of the committee, but upon motion of this illustrious philosopher, Mr. Babbage was named in his stead, and Mr. Drinkwater perpetual secretary, charged with receiving the communications addressed to the committee.

The attention of the committee of statistics was first directed to the necessity of having exact accounts of the population, and we must grant that this necessity is very urgent in England, especially with regard to births. Parliament is now engaged in devising plans for giving precision to this statistical element, and is collecting with care all the documents which can give any information on this nice point. Mr. Bowring proposed to me, at London, to submit to an

examination by a committee of parliament, in order to give information with regard to the census taken among us in 1829, and on the plan of registers in our country. I submitted to it with pleasure, happy if I could aid in establishing plans which might give more precision to a subject so important as that of population. Few countries, from the position, boundaries, and civil registers, deserve so much as ours to be studied in reference to population. Sweden and Switzerland have for a long time attracted the attention of the learned, with regard to the same subject. The reports that I presented at Cambridge, and the promise that I thought I could give that our government would willingly make any investigations beneficial to science, led me to think that our country might be selected as offering all desirable facilities for studying this subject. This state of things, of which we shall be the first to reap the fruits, will without doubt be valued as it should be, and I venture to believe that this will be one of the most happy results of our scientific relation with England.

Mr. Malthus, in consequence of the proposals that I thought myself authorized to make, wished me to ask the following questions, which I hastened to send to the Minister of the Interior, who has promised to collect the elements necessary to answer them in a satisfactory manner. They wish to know—

The number of births arising from each marriage;

What proportion of the children attain a marriageable age;

The number of living children from each marriage;

The wages for manufactures and agriculture in different provinces, particularly the price of a common day's work of a laborer;

The quantity of wheat which such a day's wages will purchase in ordinary times;

The average price of different kinds of grain;

The usual food of a day laborer;

The proportion of barren marriages;

The proportion of marriages which have produced five or more living children.

The committee also expressed a wish to know the measures taken by the Belgian government, since 1815, for the reduction of mendicity.

The answers to these questions, in the hands of competent persons would produce for ourselves valuable results.

Persons the most interested in political science hold meetings at London, where they discuss the subject of their studies and mutually enlighten each other. These discussions, altogether scientific and friendly, at which twenty or thirty persons attend, take place after a meal and generally turn on the political questions of the day. They had the goodness to admit me to one of them, where the subject was, the work required from children in the manufactories. At this meeting, many of the most distinguished political economists of England were present, namely, Messrs. Malthus, Senior, Tooke, Lewis, Whately, Babbage, &c.; our minister plenipotentiary at London, Mr. Van de Weyer, whose duties have not turned him from the subject of his first studies, is also a member of this society and took part at the same meeting.

Observatories.—The observatory at Cambridge has received many valuable additions since my first visit in 1827. Besides the great transit instrument with a focal distance of ten feet, they have now a mural circle of ten feet diameter and a new equatorial of a very elegant form, constructed by Messrs. Troughton and Simms. This equatorial, in every respect similar to that which the same artists are now making for the observatory at Brussels, is furnished with two circles three feet in diameter; the vertical circle is between four cylindrical columns, which rest upon the hour circle and are placed in the direction of the poles. These three fine instruments place the Cambridge observatory among the first in Europe; no one is better qualified to give renown to this noble establishment, than Mr. Airy its superintendant, whose name is equally distinguished in the different branches of mathematical science.

The royal observatory at Greenwich has not been much changed for many years. The great Zenith sector however has been put in place. Observations on the stars and planets are still made with diligence, in this fine establishment, which together with the observatories at Cambridge and Armagh, publishes its operations with a regularity which is of the greatest advantage to science.

The compilation of the Nautical Almanac, entrusted to Mr. Stratford, has just been extended so as greatly to increase its usefulness to astronomers and especially to navigators. For some time, the publication of this interesting collection was delayed, but owing to the care of the present compilers the volume for 1834, which has just been published, will be soon followed by that for 1835, and every thing leads us to hope that we may in future procure these ephemerides some

years before it is necessary to use them, which is indispensable especially for long voyages. The royal astronomical society powerfully seconds by its encouragement, and by the valuable papers which it publishes, the impetus which astronomy is now receiving in England.

I have also paid another visit to Mr. South's observatory where I received, on my first tour, so kind a reception; a reception which was renewed to me by the able observer, who has built this observatory at his own expense. The observatory has been enriched, since 1827, by Mr. Cauchoix's large telescope, and Mr. South has spared no pains to give it a proper position and a parallactic support. Unfortunately, the construction of the support, entrusted to very skilful hands, has not succeeded so well as other works of the same artists. Perhaps additional improvements may give more stability to it, but in its present state it would be impossible to keep a star under the threads, or to take a micrometric measurement, the path of the star being too undulating to allow of accurate results. *From the mathematical und physical correspondence, Vol.* 8, *No.* 1.

Part II.—Meeting of the British Association at Edinburgh, September 8, 1834.

President, Sir Thomas M. Brisbane, Bart. &c. &c.
Vice Presidents, Sir David Brewster, and Rev. J. Robinson, D. D. Astron. Roy. at Armagh.
Genl. Sec.—Rev. W. Vernon Harcourt, F. R. S. &c.
Treasurer,—John Taylor, Esq. F. R. S. &c.
Asst. Sec.—Prof. Phillips.
Local Sec.—John Robinson, Esq. Sec. R. S. E. and Prof. Forbes.

INTRODUCTORY MEETING.

Monday, September 8.—The meeting was opened in the St. George's Street Assembly Rooms, at 8 o'clock, P. M., by an eloquent address from Prof. Sedgwick, the President of the meeting of the preceding year. He adverted to the origin of the association, to its various meetings, first at York, next at Oxford, next at Cambridge, and now at Edinburgh; to the decided manifestations of public favor; to the great numbers of illustrious men whom the Scottish capital had produced; to the eminent individuals brought together by this association; to M. Arago, perpetual secretary of the French Institute, and Dr. Vlastos of Greece, now present; to the

feebleness of man when alone, and his great efficiency when acting in combination; to man's power over the brute elements; and to various natural phenomena whose investigation had been begun or extended, in consequence of hints given at former meetings of this association. He mentioned particularly, the fusion of bodies, to be sustained, probably during ten years, for the purpose of ascertaining the effects of long continued heat, and to observations on the tides, which are in progress, and he happily vindicated the good moral tendency of physical investigations. Sir Thomas Brisbane, on taking the chair, made an appropriate address, and complimented his predecessors. Professor Robinson then stated the plan for the business of the meeting, and for the accommodation of the members. Professor Forbes gave an address, explanatory of the objects of the association,—recapitulating what had been already accomplished, or what is in progress.

As it is impossible, consistently with our limits, to give a detailed account of the doings of this important meeting, we can select only a few prominent facts, under the most important heads, and refer the reader to the fuller account contained in the Edinburgh New Philosophical Journal for Oct. 1834, conducted by Professor Jameson; and to the volume which will doubtless be published, in which at least the most important papers will be given at large, while on the present occasion, we cannot give even a full catalogue of the titles.

As on former occasions, the meeting was divided into sections which met separately in the mornings, and in the evening a report of their doings was made to the general meeting; this meeting was held in the large assembly room, and there, strangers were allowed to be present, and among them were many ladies.

MATHEMATICS AND GENERAL PHYSICS.

Chairman, Rev. Prof. WHEWELL.

Sept. 10.—*Rain.*—Prof. Phillips read a second report of the quantity of rain, observed by himself, and Mr. Gray, to have fallen, at different elevations, above the ground.

Edinburgh Observatory.—An Observatory having been erected, on the Calton Hill in Edinburgh, at an expense of £5000, its situation is stated by Prof. Robinson to be improper, and as Sir David Brewster mentions, in the same connexion, the decay of the object glass of the transit instrument, and Mr. Arago stated facts of this nature, within his knowledge, we are led to presume, that the effect may be a chemical one, arising from the action of the marine air on

the alkali of the glass; this remark would however not apply to glasses at Paris, which is far from the sea.

Prof. Robinson recommends, that the present observatory should be used for magnetic experiments, but this is objected to by Prof. Wallace,* because the rock† of the Calton Hill is highly magnetic.

Sept. 12.—*Life Apparatus.*—Mr. Murray described an apparatus for communicating between a stranded vessel and the shore; with a method of illuminating, by night, the path of the arrow and the vessel; this, if effectual, must be very important.

Mode of Registering Meteoric Phenomena.—Mr. Adie, optician in Edinburgh, communicated a register of the weather, for ten years, in which the state of the thermometer and barometer was shown by undulating lines; the depth of the rain of each day by a broad red line; the thunder storms by a scarlet mark; the aurora by a blue one; and a part of the space, allotted to each day, was tinted of a particular color, to represent the direction of the winds, so that the views of the weather, for the different years, had only to be compared together, and it would, immediately, be seen which of them had been remarkable for heat, rain, steadiness of weather, or the contrary.

Expansion.—Mr. Adie, civil engineer, found by a pyrometer heated by steam, that when a rod of straight grained, well seasoned oak was kept dry, it expanded only about $\frac{1}{15}$ of the rate of platinum; black marble $\frac{1}{2}$ as much as glass; sandstone of Craigleith Quarry, very nearly equal to cast iron.

CHEMISTRY AND MINERALOGY.

Chairman, Prof. C. Hope.

Sept. 9.—*Atomic Weights.*—Dr. Turner expressed the opinion maintained in the Transactions of the Roy. Soc. of London, that the atomic weights of bodies cannot be represented by whole numbers. This result would lead to great practical inconvenience, although we must follow truth wherever it may lead us. Without doubt the facts will be reviewed by others.

Mercury.—Dr. Thomson believed that the mercury imported into Britain is pure.

Sept. 10.—*New facts in relation to Combustion.*—Dr. Charles Williams shewed, that many organic substances exhibit, in a dark place, a pale lambent flame, like that of phosphorus just below active combustion; this happens, when vapors begin to be evolved;

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* In a separate paper. See Jameson's Journal, October, 1834.

† It is a porphyritic trap.

this feeble flame has little heating power, and passes to ordinary flame, by a rapid transition, accompanied by a feeble detonation.

Some metals, as zinc and potassium, shew the same phenomenon, but, owing to speedy oxidation, it ceases sooner in them than in organic bodies.

The application is obvious, in suggesting to manufacturers the danger of sudden inflammation, as in candle and soap-making, in which vapors are exhaled, during the whole process of manufacture.

Coal tar and water for fuel.—Dr. Daubeny brought forward the economical use of coal tar in connexion with water as a fuel.*

Mr. Low stated that, from long experience he was convinced that water was of no service in generating heat with coal tar, and that three gallons, or thirty three pounds of coal tar are equal in heating effect to forty pounds of coke, made from the Newcastle coal of the Hulton seam.

The conclusions drawn from a somewhat protracted discussion, were, 1. That tar is not much superior, as a fuel, to the same weight of the best coal. 2. That when mixed with water, it flows more easily through tubes, but does not appear to evolve more heat than when used alone.

Sept. 11.—*Sulphur in Bar iron.*—Mr. West shewed, that the best bar iron gives off sulphuretted hydrogen during its solution in muriatic acid, and that sulphur being present in most malleable irons, injures their properties.

Amber from Ava.—Sir David Brewster gave a notice of a large specimen of amber from Ava, which was intersected by thin layers of carbonate of lime.

Carbonic acid in the atmosphere.—Mr. W. H. Watson showed that in the town of Bolton, twelve observations in the country, gave in 10,000 parts of air, carbonic acid 4.74 for a maximum ; 3.89 for a minimum ; mean 4.135 ; in the town, nineteen observations gave the maximum 8.62 ; minimum 4.19 ; mean 5.30.

Sept. 12.—*Hot blast.*—Dr. Clark stated, that in Mr. Nixon's process for smelting iron by the hot blast, one ton of iron is now produced by two tons, fourteen cwt. of coal, instead of eight tons, one and a half cwt. formerly required, thus causing a saving of five tons, eight cwt.

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* This has been long known in this country ; the fact was discovered by Samuel. Morey, and an account of his process, may be found in the first vol. Am. Jour. of Science, 1818 ; and many experiments by him in subsequent volumes, passim.

Mr. Kemp gave an account of a new mode of liquefying the gases, by which they may be obtained, much more easily, and in much larger quantities. Among the properties of the liquefied gases, he stated the independent bleaching power of chlorine, and of sulphuretted hydrogen, when liquid.

Mr. Fox read a communication on the electro-magnetic condition of certain veins, and the continuation of the experiments was recommended.

GEOLOGY AND GEOGRAPHY.

Chairman, Prof. JAMESON.

Sept. 9.—*Slaty structure.*—Dr. Boyle stated, that, from his own observations, all the characters of stratification usually ascribed to primary slates, do occur in granites also, and that the essential structural characters of these slates are continued into the neighboring granites; he thence inferred, that, there is no real structural distinction between the granites and the primary slates.*

This opinion was either opposed, or the difficulty was, to a degree modified, by different gentlemen present, and Prof. Sedgwick stated, that, he had adopted the same opinion as that of Dr. Boyle, after a visit to Cornwall, sixteen years ago, but that an investigation in North Wales and Cumberland, had considerably altered his views.

Gradual elevation of parts of Sweden, &c.—Mr. Lyell, being invited, gave an oral statement of his observations in Scandinavia, as to the supposed change in the level of the Baltic.

Celsius, more than one hundred years ago, contended, that the level both of the Baltic and of the main ocean, was undergoing a gradual depression, and he referred to the following proofs:

1. Towns with sea ports, formerly, situated on the coast of the Gulf of Bothnia, are now far inland, and new tracts are becoming dry along the shores; to this, the inhabitants bore testimony.

2. They also say, that various insulated rocks in the Gulf of Bothnia, and on other parts of the eastern shores of Sweden now rise higher above the sea, than formerly, as seen in their youth.

3. Marks were cut in the fixed rocks on the shore, thirty years before, or more, to indicate the extreme altitude of the waves, when

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* In this country, there can be no question that granite is, in general, clearly distinguished from the primary slaty rocks, as is plainly seen in all quarries where these rocks are cloven; gneiss, mica slate, and the other slates cleave, easily, through their slaty structure, while granite shews no such disposition, but splits, as readily in one direction, as in another.—*Ed.*

ranged by high winds, and that those marks indicated a sinking of the waters, at the rate of three or four feet in one hundred years. It was objected, that similar results were not obtained in every part of the Swedish coasts; that land was accumulating at the mouths of rivers, &c. and that by the winds any marks were rendered very uncertain indications of the sea level. Von Buch, twenty five years ago, observing that the sand and mud of several places on the western shores of Scandinavia contained shells, like those existing in the present seas, inferred that there had been a change of level, and as water cannot undergo a partial depression, he concluded that Sweden and Finland were slowly rising.

Mr. Lyell visited some parts of the shores of the Bothnian Gulf, between Stockholm and Gefle, and of the western coast of Sweden, between Udevalla and Gothenburg, districts particularly alluded to by Celsius. He had examined several of the marks cut in 1820, by the Swedish pilots, under the direction of the Swedish Academy of Sciences, and found the level of the Baltic in calm weather, several inches below the marks. He also found the level of the waters, several feet below marks made seventy or one hundred years before. He obtained similar results on the side of the ocean, and found, in both districts, that the testimony of the inhabitants agreed exactly with that of their ancestors, recorded by Celsius. After confirming the accounts given by Von Buch, of the occurrence, on the side of the ocean, of elevated beds of *recent* shells, at various heights, from ten to two hundred feet, Mr. Lyell added, that he had also discovered deposits on the side of the Bothnian Gulf, between Stockholm and Gefle, containing fossil shells of the same species which now characterize the brackish waters of that sea. These occur at various elevations, from one to one hundred feet, and sometimes reach fifty miles inland. The shells are partly marine and partly fluviatile; the marine species are identical with those now living in the ocean, but are dwarfish in size, and never attain the average dimensions of those which live in waters sufficiently salt to enable them to reach their full developement. Mr. Lyell concluded, by declaring his belief, that certain parts of Sweden are undergoing a gradual rise to the amount of two or three feet in a century, while other parts visited by him, farther to the south, appear to experience no movement.

Coal of Fyfeshire and Edinburgh.—Lord Greenock stated, on the authority of Mr. Landale and Mr. Bald, that in Fyfeshire, there

are twenty nine beds of coal, of the united thickness of one hundred and nineteen feet, and that in the Edinburgh district, there are from twenty six to twenty nine beds of the thickness of one hundred and nine feet.

The nodules of iron stone in the bituminous shale of Wardie generally contain an organic nucleus, either a coprolite, or some portion of a fish.

Organic Remains in the Limestone of Burdic House.—In the limestone of Burdic house, there are bones of gigantic animals, various undescribed fish, large scales and coprolites.

There are pointed teeth, three and three fourths inches long, and one and a half wide at their base, resembling those of Saurian reptiles;* the teeth and the numerous large scales, are beautifully enamelled of a brown tint. There were also bony rays fifteen inches long, and of course, they must have belonged to some huge fish.

Mr. Agassiz was of the opinion, that these relics belonged to a fish, of a new and extraordinary genus, partaking of the character of reptiles, of that class of animals which appear elsewhere in great numbers, only at a geological era much later than that in which these are deposited.

Sept. 11.—*Structure of recent and fossil wood.*—Mr. Nicoll read a paper on the structure of recent and fossil wood, with numerous specimens illustrative of his observations, and of his method of obtaining thin sections, so as to be transparent, and to exhibit the structure, in the manner, we believe, first invented and put into practice, by Mr. Witham.†

Fossil Fishes.—Fossil fishes are found, abundantly, in the Orkneys, and in Caithness; Mr. Agassiz refers them to an era earlier than the coal measures.

Geology of North America.—A paper was introduced from Dr. Harlan, on the fossil organic remains of the United States.‡

Mr. Murchison gave an abstract of Dr. Rogers' report on the Geology of North America; the following are the conclusions drawn by the author.

1. The deposits of New Jersey differ from those of the southern States, in being chiefly arenaceous, and in containing an immense quantity of the pure chloritic mineral, called green sand.

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* Rather Saurian fish, according to the opinion of the celebrated M. Agassiz, who examined them.

† See this Journal, Vol. xxv, p. 108, and Vol. xxvii, p. 415.

‡ See this Journal, Vol. 27, p. 347.

2. The organic remains, hitherto discovered, are nearly all, with the exception of one or two species, peculiar to this continent.

3. The existence of great quantities of lignite, of the remains of scolopax, a shore bird, and the position of these beds in New Jersey contiguous to the primary boundary of ancient coast, all indicate that these beds were deposited in a comparatively shallow sea, analogous in position to the present extensive line of soundings which skirt the coast. The obvious shallowness of the portion of the secondary ocean where these beds were formed, may, perhaps, help to explain the remarkable discordance alluded to, between the American and European marine species of this period.

4. The calcareous masses of Alabama, at least the upper beds, are possibly different in age from the marls and arenaceous beds of New Jersey.

5. The marl formation of New Jersey is, perhaps, most nearly represented by the European green sands. The limestone deposits in the south, on the other hand, resemble more the upper members of the cretaceous group, for example, the formation of the plateau of Mæstricht.

6. Thus far, there is no evidence of the existence of true chalk in North America. Genuine flints have not yet been found in any bed.

7. Volcanic forces, during this period, seem to have been nearly dormant, which may perhaps assist in accounting for the absence of the chalk.

8. The want of coincidence, both in organic remains, and mineral character, between these beds, and the cretaceous group of Europe, the difficulty of deciding their identity at present, from a want of a sufficient knowledge of the structure and superposition of our formation; and above all, the importance of preserving our geology, free from the shackles of a nomenclature, originally adapted to another continent, render it desirable that we reject the terms in use, and appropriate to this group of formations a name, which shall be independent of old associations, and yet express their position, in the geological series. Mr. Lyell, expressed the high opinion he entertained of the labors and theoretical views of Professor Rogers.

Geological position of Fossil fishes in England and Scotland.—Mr. Murchison shewed, that fossil fishes are common to the central portion of the old red sandstone of England, and the strata occupying the same geological position in Forfarshire, and other counties in

Scotland. M. Agassiz gave a very interesting and instructive view of the fossil fishes of Scotland. They are very numerous, but the facts concerning them cannot be conveniently condensed; for detailed information, the fuller report must be resorted to, in Jameson's New Edin. Jour. Oct. 1834.

Mr. Saul exhibited drawings of the incisors and canine teeth of the fossil hippopotamus, from a gravel pit near Huntingdon.

NATURAL HISTORY.

Chairman, Prof. GRAHAM.

Sept. 9.—*Genus Salmo.*—Professor Agassiz presented a view of the Genus Salmo, as found in Europe. While the ventral fins are of a middling size, the caudal fin is attached to a very fleshy root, and is moved by very powerful muscles. This elastic spring is, to these fishes, a most powerful lever; when wishing to leap to a great height, they strike the surface of the water with a kind of double stroke. By this means, they overcome obstacles which appear insurmountable, and leap over nets which are intended to confine them. The most formidable water falls can scarcely arrest them. The several species of this genus are found in the northern and temperate regions of Europe, Asia, and America.

The fishes of this family are very ravenous, their food being principally, the larvæ of aquatic and other insects, and of the small crustacea, and little fishes.

The swimming bladder is very large, and opens into the æsophagus, near the bottom of the gullet.

Prof. Agassiz expressed the extraordinary opinion, that this organ is the lungs of fishes, and that their branchia are not, as has been supposed, analogous to the lungs of other animals.

Most of the salmon varieties reside in fresh waters; go to the sea in summer, and visit the rivers to spawn. Most of our species, (says Prof. A.) deposit their ova in November and December, and the young fry, coming into being in cold weather, can support all variations of temperature.

The colors of the different kinds of Salmo vary with the seasons. Their tints are most vivid in October, November, December, and January; and "we might almost say that these fishes deck themselves in a nuptial garb, as birds do." The fishes of the salmo family are very widely distributed, and some of the varieties are much valued for the table. Those of the continent of Europe may be included within the following six species:

1. Salmo Umbla, *Lin.* the char of Eng. Salmo Alpinus, *Lin.* Found in England, Ireland, Sweden, and all South Germany.

2. Salmo Fario, *Lin.* The trout of brooks,—common trout, distribution extensive as the above.

3. Salmo Trutta, *Lin.* Sea trout,—Salmon trout. Salmo Lemanus of Cuvier, distributed extensively as the preceding.

4. Salmo Lacustris, *Lin.* Found in the Lakes of Lower Austria, and in the Rhine above Constance.

5. Salmo Salar, *Lin. The true salmon.* The Salmo *Hamatus* of Cuvier is the old fish, and the Salmo *Gadeni* of Bloch is the young fish. Found in the northern seas, whence it ascends the rivers, even as far as the Swiss lakes.

6. Salmo Hucho, *Lin.* Of the same species as the preceding: peculiar to the waters of the Danube.

The different species of the salmon family are very widely distributed; they thrive in all climates; at least, at all elevations above the ocean, whether in fresh water or salt, but they prefer limpid water.

Sept. 11.—*New work on Vertebral Animals.*—Prof. Jameson exhibited a splendid collection of colored drawings of the vertebrate animals of Great Britain and Ireland, by Mr. William Macgillivray; they combined beauty and accuracy; and form a part of a great collection, intended for publication, under the title of *The Mammalia, Birds, Reptiles, and Fishes of Great Britain and Ireland.*

Propagation of Scottish Zoophytes.—Mr. Graham Dalzell read a very valuable paper on the propagation of Scottish Zoophytes.

We have not room even for an intelligible abridgment of the abstract of this important paper, and can mention only a few facts.

1. The *actinia equina* produced over two hundred and seventy six young in six years; the embryos first appear on the tips of the tentacula, one of which being removed with its embryo began to breed in fourteen months, and survived five years.

2. The *Hydra tuba*, or trumpet polypus, a new Scottish species; about two inches in diameter; it waves its long white tentacula in the water, propagates by an external shapeless bud, and in thirteen months gave eighty three descendants; the group was watched five years.

3. The *Tubularia indivisa* is rooted to rocks and shells by a stalk above one foot high, with a scarlet head, like a beautiful flower: it is full of tentacula. Splendid groups occur of fifty or even one hun-

dred specimens. The ovarium consists of botrioydal clusters, and is borne on the head whence an ovum falls, and is developed below, shooting out tentacula, which serve first as feet, by the aid of which the animal enjoys a degree of locomotion, and is thus enabled to choose his points of future fixture, but the tentacula are finally reversed, and a stalk, growing from under the head, attaches the zoophyte to a rock.

4. *Sertulariæ* are generally shrub-like, with thousands of cells, containing their appropriate polypi; the Sertularia Uber is three feet high from the root. The animal crawls, actively at first, but dies, and another springs from its ruins. Plantations of hundreds of Sertulariæ may be easily obtained.

5. The *Flustra Carbasca* resembles a leaf, studded with cells, all of which, are inhabited by vivacious polypi.

All the preceding are marine, and propagate, although solitary.

6. The *Cristatella mirabilis* inhabits the fresh waters of Scotland, and is the most remarkable of polypiferous products. From one hundred to three hundred polypi are grouped in an ellipsoidal figure; each polypus, although an integral portion of the common mass, is a distinct animal, with individual sensation and action. It consists of a fleshy stem, with a horse head, and having about one hundred tentacula. The entire mass can move slowly, bearing along, it may be, three hundred animals. A single polypus of this kind can produce one thousand animals.

The stalk of the Sertularia polygonias has the power of reproducing its heads, which are deciduous after recovery from the sea, and a redundance of heads may be produced by artificial sections. Thus twenty two heads were produced in five hundred and fifty days from three sections of a single stem.

The reproductive powers of some animals are very great. The amphitrite ventilabrum, and others of that genus have, from fragments of the largest specimens that could be obtained from the lower extremity, regenerated the complex and beautiful plume. All the preceding results, with others, equally singular, were illustrated by drawings by skilful arrists.

Sept. 12.—*Singular variety of the Human Race.*—Mr. Pentland offered reasons for believing, that there existed, at a comparatively recent period, between 14° and 19° S. lat., a race of men, in whose crania two thirds of the cerebral mass, was placed behind the occipital foramen, and in which the bones of the face are very

much elongated, like apes, and these peculiarities, Mr. P. contended, could not be produced by pressure or external force.

The bones of this race, are found in ancient tombs in the mountains of Peru and Bolivia, and principally, in the great interalpine valley of Titicaca, and on the borders of the Lake of the same name. The architecture of the tombs is beautiful, and appears to belong to a period not more than seven hundred or eight hundred years ago.

This race of men, appears to have preceded the present Indian races which bear the characters of Asiatics.

ANATOMY AND MEDICINE.

Chairman, Dr. ABERCROMBIE.

Sept. 10.—*Change of color in the Chameleon.*—Mr. Murray of Hull, made a communication on the change of color in the Chameleon. He stated, that the *agama* or Mexican Chameleon and the *polychlorus*, display a change of color, or tint in the skin, and noticing some of the more striking points in the history of the chameleon, such as the biennial casting of its skin, he proceeded to state his opinion, that the electro-chemical action of the sun beam through the skin upon the blood, modified by impulse, produced the changes in question. He had made experiments, which appeared to him to prove, that there is a change of temperature connected with the change of color; the thermometer varying from 73° to 75°, when the ambient air was 72°.

Effect of Ventilation on the Mortality of Infants.—It appeared from a register kept in the Lying-in Hospital in Dublin, that during the seventy five years, between 1758 and 1833, relief had been afforded to one hundred and twenty nine thousand poor women, that in 1781, every sixth child died by the ninth day, of convulsive disease, but that now, owing to a more thorough ventilation, the mortality, in five successive years, is reduced to one in twenty. Communicated by Dr. Abercrombie.

Sept. 12.—*Regulation of the Sanguineous Circulation.*—Dr. T. J. Aikin communicated the result of his enquiries into the varieties of mechanism, by which the blood may be accelerated or retarded in the arterial and venous system of the mammalia.

1. By the angle at which the branch comes off from the trunk.
2. The direction of the vessel.
3. The subdivision.
4. The formation of plexus.

To illustrate the first, the aorta of a tiger was shewn, in which the superior intercostals arose at an acute, the middle at a right, and the lower at an obtuse angle, thus rendering the force and velocity of the blood, equal through the whole series. For the second, he named the tortuous entrance of the internal carotid and vertebral arteries into the skull of the human subject.

In the horse and other ruminantia, it is still more remarkable, on account of the great length of time in which they must keep their heads in a prone position. The third was illustrated by the sloth and hedgehog. The fourth by the ruminantia—the existence of the rete mirabile in the ophthalmic artery of the seal and goose, and in the mesenteric arteries and veins of the hog.

Excision of important joints.—Prof. Syme exhibited several patients who had suffered the excision of the elbow and shoulder joints with safety.

STATISTICS.

Chairman, Sir Charles Lemon, Bart.

Sept. 9.—*Population of Manchester—Condition of a part of it.*—It appears from a document of the Statistical Society of Manchester, that the number of families visited by a Committee, was 4102, consisting of nearly 20,000 persons, occupying 3110 houses, and 1002 cellars and aparments, of which only 689 were well furnished, 1551 were comfortably furnished and 2551 were uncomfortable. Of the 20,000 persons, 7789 receive wages and only 158 pay a rent over four shillings per week. In the same district there were 8121 children under twelve years, of whom 252 attended day schools, 4680 Sunday schools, and nearly half were without education. The number of persons, who stated that they were able to read was 3114.

Sept. 10.—*Proportion of Males to Females in Glasgow.*—It appeared from the statements of Dr. Cleland, that in Glasgow, as elsewhere, there are more males born than females, but that in every period over fifteen years of age, the proportion of living females predominates.

Sept. 12.—*Statistical Societies.*—Mr. Drinkwater stated that the Statistical Society of London already consisted of nearly four hundred and fifty members, and that it was actively employed in encouraging the formation of similar societies in every part of the United Kingdom.

Statistique Morale de France.—Captain Maconochie gave an account of M. Guerry's Essai sur la Statistique Morale de France.

If France be divided into five several regions or districts, it appears that the proportion of crimes in each region, is very nearly equal from year to year.

The summer months are more productive of crimes against persons, the winter months against property, and crimes against property, are three times as numerous as against persons. Crimes do not appear to be increasing in France.

Second accusations are numerous, but a man, once condemned to the galleys, seldom renders himself again liable to that punishment. Men commit almost every species of crime, much more frequently than women; the crimes against children are equally divided between the sexes.

In one hundred crimes against persons, men commit eighty six, and women fourteen—against property, men seventy nine, and women twenty one. Two fifths or nearly one half of the crimes committed by women against the person, are for infanticide. The greatest ignorance in France, is on the west coast—in the centre and not in the south as has been supposed. The greatest amount of crimes is in Corsica and Alsace.

In both sexes, the greatest amount of crimes is committed between the ages of twenty five and thirty, which embrace nearly one fifth of the whole.

Mr. Guerry concludes that education is a mighty instrument, powerful either for good or evil, according as it is directed, and that, unless while we inform the intellect, we also take pains to cultivate the moral sentiments, and to touch the affections of the heart, we bestow but a doubtful advantage on its object.

Rate of mortality among rich and poor.—A paper of Mr. Murray was read by the Secretary, shewing that the rate of mortality is less in the higher than in the lower orders of society, the opulent being the longest lived.

This must arise from their superior comfort, and in manufacturing towns, the best workmen who receive the highest wages are often dissipated, improvident, and therefore short lived.

Sept. 9.—*Evening Meetings—George street Assembly Rooms.*—The treasurer reported the progress of the Institution. At its first meeting at York, in 1831, it numbered 350 members—at Oxford in 1832, they increased to 700—at Cambridge, 1833, to about 1400. It is added in a note that on the last day in Edinburgh the number enrolled (additional we presume) was 1298. A letter was read from

Mr. Rumker of Hamburgh with an ephemeris of the track of the comet of 1682 and 1759, whose return is expected at the end of this year; various remarks were made upon comets by Profs. Robinson, Whewell and Hamilton.

10. Dr. Lardner, by request, explained the principle of Mr. Babbages celebrated calculating machine, as for as it could be done without models or the machine itself.

11. Dr. Buckland delivered a very animated and instructive lecture on fossil amphibia and fishes. We understand from a friend who was present, an American Lady—that the lecture was illustrated by drawings of the Saurians, &c. and that Dr. Buckland is not less distinguished for his scientific attainments, than for his brilliancy and felicity of language.

12. Dr. Abercrombie, after stating his very great satisfaction at the meeting, expressed the sentiment, that "those who have made the greatest attainments in true science will be first to acknowledge their own insignificance, when viewed in relation to that omnipotent one who guides the planets in their courses and maintains the complicated movements of ten thousand suns and ten thousand systems in undeviating harmony; he was satisfied that infidelity and irreligion are the offspring of ignorance and presumption, and that the boldest researches of science, if conducted in the spirit of true philosophy, must lead us to new discoveries of the power and wisdom and harmony and beauty, which pervade the works of him who is eternal." Prof. Sedgwick echoed the sentiments of Dr. Abercombie, that the pursuits of science, instead of leading to infidelity have a contrary tendency—that they tend rather to strengthen religious principle and to confirm moral conduct.

Sept. 13. We have omitted to repeat what was mentioned, in the beginning of this abstract that, on the different evenings, reports were made of the doings of the various sections.

The concluding meeting was held at 2 o'clock P. M. in the splendid hall of the library of the University; there was a great rush for admission and at 3 o'clock the hall was filled. The President Sir Thomas M. Brisbane, announced that invitations for the next meeting had been received from the Bristol Institution, from the Lit. and Phil. Soc. of Liverpool, from the Roy. Irish Acad. the Roy. Dublin Soc. and the Univ. of Dublin and that the committee had agreeed to adjourn the association to Dublin to meet on the 10th of August 1835. The Rev. V. Harcourt stated that £830 of the funds of the association had been appropriated, for the promotion of research-

es in physical, chemical, geological, zoological, botanical and medical science, and he mentioned the individuals and particular subjects.

Dr. Buckland moved that the thanks of the association should be presented to the University, for the liberal use of their apartments. He warmly expressed his sense of the great hospitality of Edinburgh. "They had been welcomed to the houses and to the tables of the inhabitants—nay, the very rocks of the country had welcomed them by opening before them their valuable treasures; they had seen that spices had formerly waved on the tops of the Grampians, while crocodiles swam at their bases; and a thousand fishes had started from their rocky sepulchres, to bid welcome to the members of the British association, for the advancement of science." Various votes of thanks were passed and in seconding that proposed by Prof. Whewell to the President of the association, Prof. Hamilton of Dublin alluded to Sir David Brewster, as having done more than any living man for the science of optics; "that wonderful science, which, illustrating each by each, the more beautiful phenomena of light and the subtlest properties of matter, enables us almost to feel the minute vibrations, the ceaseless heavings and tremblings of that mighty ocean of ether, which bathes the farthest stars, yet winds its way through every labyrinth and pore of every body on this earth of ours.

He bestowed also a merited commendation upon Sir Thomas M. Brisbane for the erection of that Oriental observatory, without which the comet of Encke, at one of its late returns, would have eluded human scrutiny; since, although it was then visible in the southern, it was invisible in the northern hemisphere. The Paramatta observations had afforded important aid in determining the amount of astronomical refraction, that property of our atmosphere which here, bends the rays of Sirius towards our pole, but bends them there, towards the other.

Professor Sedgwick, in proposing the thanks of the association to M. Arago and the other distinguished strangers who had visited them, threw out some eloquent thoughts upon the advantages of Science in smoothing the prejudices of different nations, and linking together the learned men of all countries, and paid a high compliment to the merits of M. Arago.

Lord Chancellor Brougham who had arrived only at this concluding meeting, made some pertinent remarks upon the influence of scientific intercourse in preventing war, and seconded the motion of Prof. Sedgwick. M. Arago returned thanks in a very energetic speech.

Thanks were returned to the general Secretary, Rev. Vernon Harcourt* for his great and successful exertions. The President Sir Thomas M. Brisbane, declaring that it was the only painful duty imposed upon him during the week, then adjourned the society, to meet at Dublin, August 10, 1835, when the meeting separated.

Among the subjects already promoted, or to be encouraged by the British Association, Prof. Forbes mentioned—

The investigation by Mr. Taylor, of the formation of mineral veins, in which it can scarcely be doubted that electric agency is concerned.

The subject of terrestrial magnetism, especially as regards the direction and intensity of its energy, which is subject to abrupt and capricious changes, which Baron Humboldt, calls *magnetic storms*.

Hourly observations on the thermometer, have been commenced in the south of England, and the same train of observations is to be taken up in India.

A regular system to ascertain the rate at which rain falls, at different heights, has been undertaken by Messrs. Phillips and Gray, at York.

A regular system of Auroral Observations, extending from the Shetland Islands to the Lands End has been established; the influence on the magnetic needle is included.

Prof. Phillips is preparing *an elaborate synopsis of Fossil Organic Remains.*

Observations on the tides have been undertaken by the Lords of the Admiralty *at above five hundred stations*, along the coast of Britain.

America has taken the lead in several departments of experiment recommended by the association, and the instructions for conducting uniform systems of observation, have been reprinted and circulated in the new world.

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* Prof. Forbes in his address before the association states, that to the exertion of this gentleman, almost single handed and alone, is due the signal merit of establishing a permanent society, of which these annual reunions, should simply be the meetings, but which, by methods and by influence peculiarly its own, should, during the intervals of these public assemblies (whilst to the eye of the world apparently torpid and inactive) be giving an impulse to every part of the scientific system, maturing scientific enterprize, and directing the labors requisite for discovery. Not only for the first conception of the idea, but for the construction of the machinery in all its details, the association is indebted to the Rev. Vernon Harcourt.

Art. VII.—*Of the Composition and Resolution of Forces, and Statical Equilibrium*; by Prof. Theodore Strong.

Continued from Vol. xxvi, p. 310.

Let us resume (9), and suppose that x, y, z, are the rectangular coordinates of the material point M, when referred to three fixed rectangular axes drawn through any given point; then (9) will exist as before. Imagine planes to be drawn through the directions of R, r, r', &c. at right angles to the plane x, y and let $_{,}$A, $_{,}a$, $_{,,}a$, &c. denote the angles which their lines of intersection with the plane x, y, severally make with the axis of x. Then it is evident that cos. A = sin. C cos. $_{,}$A, cos. a = sin. c cos. $_{,}a$, &c. cos. B = sin. C sin. $_{,}$A, cos. b = sin. c sin. $_{,}a$, &c.; put R sin. C = T, r sin. $c = t$, r' sin. $c' = t'$, &c. $\therefore$ R cos. C = T cot. C, r cos. $c = t$ cot. c, &c.; substitute these values in (9), and they will be changed to t cos. $_{,}a + t'$ cos. $_{,,}a +$ &c. = T cos. $_{,}$A, t sin. $_{,}a + t'$ sin. $_{,,}a +$ &c. = T sin. $_{,}$A, t cot. $c + t'$ cot. c' + &c. = T cot. C, (11); where it is evident, that T, t, &c. are the values of R, r, &c. when resolved in a direction parallel to the plane x, y, and that T cot. C, t cot. c, &c. are the values of the same quantities when resolved in a direction perpendicular to the same plane. To the first of (11) multiplied by y, add the second multiplied by $-x$, and we have $t\,(y \cos.\ _{,}a - x \sin.\ _{,}a) + t'(y \cos.\ _{,,}a - x \sin.\ _{,,}a) +$ &c. = T $(y \cos.\ _{,}\mathrm{A} - x \sin.\ _{,}\mathrm{A})$, (12); draw from M a perpendicular to the axis of z, and from their intersection draw the perpendiculars P, p, p', &c. to the directions of T, t, t', &c.; then we shall evidently have $y \cos.\ _{,}\mathrm{A} - x \sin.\ _{,}\mathrm{A} = \mathrm{P}$, $y \cos.\ _{,}a - x \sin.\ _{,}a = p$, &c. hence (12) becomes $t\,p + t'\,p' +$ &c. = T P, (13). If we suppose the force t, to be applied to the extremity of p, it will tend to turn it around the axis of z; $t\,p$ is called the *moment* of the force r, relative to the axis of z; hence by (13) the sum of the moments of the components r, r', &c., relative to any axis, equals the moment of the resultant relative to the same axis: Mec. Cel. Vol. I, pp. 12, 13.

We will now suppose that M is pressed by the forces against any given surface, whose equation is $u = 0$, (14), u being a given function of the coordinates x, y, z, which determine the position of M; to find the conditions of the equilibrium of M upon the surface.

It is evident that M must be pressed by the forces against the surface so that their resultant may be at right angles to it, in order

that it may be destroyed by the reaction. Let X, Y, Z, denote the sum of the components of all the forces which affect M, when resolved in the directions of x, y, z, severally; Let N denote the reaction of the surface, $p=\sqrt{(x-d)^2+(y-e)^2+(z-f)^2}$ = the perpendicular to the surface drawn through M, d, e, f being the coordinates of the origin of p; we shall suppose that the origin of p is taken on that side of the surface, towards which N is directed.

Now by resolving N in the directions of $x\,y\,z$, we have $N\times\frac{d-x}{p}$, $N\times\frac{e-y}{p}$, $N\times\frac{f-z}{p}$, for the values of N when reduced to those directions; hence for the equilibrium of M, we have $X+N\times\frac{d-x}{p}=0$, $Y+N\times\frac{e-y}{p}=0$, $Z+N\times\frac{b-z}{p}=0$, (15). By the nature of the perpendicular, we have $\left(\frac{x-d}{p}\right)dx+\left(\frac{y-e}{p}\right)dy+\left(\frac{z-f}{p}\right)dz=0$, (16), and by (14) $\frac{du}{dx}dx+\frac{du}{dy}dy+\frac{du}{dz}dz=0$, (17), multiply (17) by the indeterminate L, add the product to (16), then put the coefficients of the indeterminates, dx, dy, dz separately, $=0$, and we have $\frac{x-d}{p}+L\frac{du}{dx}=0$, $\frac{y-e}{p}+L\frac{du}{dy}=0$, $\frac{z-f}{p}+L\frac{du}{dz}=0$, (18); hence $L=1\div\sqrt{\left(\frac{du}{dx}\right)^2+\left(\frac{du}{dy}\right)^2+\left(\frac{du}{dz}\right)^2}$ ∴ denoting this value of L, when multiplied by N, by N′, we shall have by (18) and (15), $X+N'\frac{du}{dx}=0$, $Y+N'\frac{du}{dy}=0$, $Z+N'\frac{du}{dz}=0$, (19); by eliminating N′ from (19) we have $X\frac{du}{dy}-Y\frac{du}{dx}=0$, $X\frac{du}{dz}-Z\frac{du}{dx}=0$, (20), for the conditions of the equilibrium of M; (14) and (20) are sufficient to find where M must be placed on the given surface, to be in equilibrium, and by (19) we have $N=\sqrt{X^2+Y^2+Z^2}$ = the force with which the surface must react in order to destroy the resultant of the applied forces. If M is to be in equilibrium on a line, which is formed by the mutual intersection of two surfaces, which are denoted by $u=0$, $u'=0$, (21); then by using the same notation as before, and putting $L'=1\div\sqrt{\left(\frac{du'}{dx}\right)^2+\left(\frac{du'}{dy}\right)^2+\left(\frac{du'}{dz}\right)^2}$, ,N=to

the reaction of u', $N''=L',N$; we shall have when M is in equilibrium, $X+N'\frac{du}{dx}+N''\frac{du'}{dx}=0$, $Y+N'\frac{du}{dy}+N''\frac{du'}{dy}=0$, $Z+N'\frac{du}{dz}+N''\frac{du'}{dz}=0$, (22); and by eliminating N', N'' from (22), we shall have $X\left(\frac{du}{dy}\cdot\frac{du'}{dz}-\frac{du}{dz}\cdot\frac{du'}{dy}\right)+Y\left(\frac{du}{dz}\cdot\frac{du'}{dx}-\frac{du}{dx}\cdot\frac{du'}{dz}\right)+Z\left(\frac{du}{dx}\cdot\frac{du'}{dy}-\frac{du}{dy}\cdot\frac{du'}{dx}\right)=0$, (23), for the equation of equilibrium required; which with (21) will enable us to find the coordinates x, y, z of the point on the line where M must be placed, to be in equilibrium. It is evident that we shall have $\sqrt{X^2+Y^2+Z^2}=$the force with which the surface must react, in order to destroy the resultant of the applied forces; Mec. Cel. pp. 9, 10, &c.

Equilibrium of a System of Bodies.

We will now consider the conditions of equilibrium of a system of bodies; whose quantities of matter are denoted by m, m', m'', &c., supposing the unit of masses to be a portion of matter so small that it may be considered as a particle: we shall also suppose the bodies m, m', &c. to be so small that every unit of each, may be considered as acted on by the forces, (which are supposed to affect them,) with the same intensity.

Let the system be referred to the fixed rectangular axes x, y, z, drawn (at pleasure,) through any given point for their origin; supposing x, y, z to be the coordinates of m, x', y', z' those of m', and so on. We shall suppose the reactions of the surfaces or lines, on which any of the bodies may be supposed to be in equilibrium; and the reactions of any fixed points which may be supposed to be in the system; together with the forces with which the bodies are supposed, or made to act (whatever may be the cause,) on each other, are included among the forces.

Let P, Q, R, be the sums formed by resolving each force (as at p. 308, Vol. XXVI,) which affects a unit of m, in the directions of x, y, z severally; and P′, Q′, R′ the corresponding quantities for a unit of m'; and so on.

Then for the equilibrium of m, we must have (as at p. 308,) $P=0$, $Q=0$, $R=0$; and for that of m', $P'=0$, $Q'=0$, $R'=0$; and so on for all the bodies of the system; hence when the system is in

equilibrium, we must have $P=0$, $P'=0$, $P''=0$, &c. (a); $Q=0$, $Q'=0$, $Q''=0$, &c. (b); $R=0$, $R'=0$, $R''=0$, &c. (c); where there are three times as many equations as there are bodies, there being three for each body; or as many as there are coordinates, $x\ y\ z$, $x'\ y'\ z'$, &c., as evidently ought to be the case, for it is indifferent, whether the position of m is determined by the forces P, Q, R, or by the coordinates $x\ y\ z$; and the same remarks are applicable to each body. It may not be improper to remark, that in forming P, Q, R, &c., we may neglect the consideration of the algebraic signs of the cosines of the angles, which the directions of the component forces make with the directions of the axes of x, y, z, provided, if we regard those forces which tend to increase the coordinates as positive, we consider those which tend to decrease them as negative; and reciprocally.

We will now consider the forces which any two bodies of the system, as m and m', exert on each other. Imagine m and m' to be joined by the straight line f, then the equilibrium will evidently not be disturbed by supposing f to be rigid; now if the conditions of the system cause m and m' to act on each other with any forces, they must act along f; for otherwise they will give f an angular or parallel motion, and the equilibrium will be disturbed. Let p denote the whole force which a unit of m exerts on a unit of m', then a unit of m' must act on a unit of m with the force $-p$, which is directly opposite to p; for otherwise f will be moved in the direction of its length, and the equilibrium will be disturbed. Hence mp = the whole force with which m acts on a unit of m', and $-m'p$ = the whole force of the consequent reaction of m' on a unit of m; by resolving these forces in the directions of the axes of x, y, z, we shall have $\left(\frac{x-x'}{f}\right)mp$, $\left(\frac{y-y'}{f}\right)mp$, $\left(\frac{z-z'}{f}\right)mp$, severally, for the components of P', Q', R', which depend on the force mp; also $-\left(\frac{x-x'}{f}\right)m'p$, $-\left(\frac{y-y'}{f}\right)m'p$, $-\left(\frac{z-z'}{f}\right)m'p$, are the components of P, Q, R, which depend on the force $-m'p$: hence (for simplicity,) considering these forces only, we shall have $P=-\left(\frac{x-x'}{f}\right)m'p$, $Q=-\left(\frac{y-y'}{f}\right)m'p$, $P'=\left(\frac{x-x'}{f}\right)mp$, $Q'=\left(\frac{y-y'}{f}\right)mp$, $\therefore\ mP+m'P'=0$, (d); also $Py-Qx=\left(x\left(\frac{y-y'}{f}\right)-y\left(\frac{x-x'}{f}\right)\right)m'p=$

$\left(\frac{yx'-xy'}{f}\right)m'p,\ \mathrm{P}'y'-\mathrm{Q}'x'\doteq-\left(\frac{yx'-xy'}{f}\right)mp,\ \therefore m\,(\mathrm{P}y-\mathrm{Q}x)+m'\,(\mathrm{P}'y'-\mathrm{Q}'x')=0$, (e).

Multiplying the first of (a) by m, the second by m', and so on for all the bodies, then adding the products we have $m\mathrm{P}+m'\mathrm{P}'+$, &c. $=0$, or denoting $m\mathrm{P}+m'\mathrm{P}'+$, &c. (for brevity,) by $\mathrm{S}m\mathrm{P}$, we have $\mathrm{S}m\mathrm{P}=0$, which is independent of the actions of the bodies on each other, for the actions of every two of them will destroy each other as in (d); in the same way by (b) and (c), we have $\mathrm{S}m\mathrm{Q}=0$, $\mathrm{S}m\mathrm{R}=0$, which are independent of the actions of the bodies on each other, as before.

Again, multiplying the first of (a) by y, and that of (b) by $-x$, then adding the products we have $\mathrm{P}y-\mathrm{Q}x=0$, in the same way by the second of (a) and (b), we have $\mathrm{P}'y'-\mathrm{Q}'x'=0$, and so on for every corresponding two of (a) and (b); multiplying the first of these equations by m, the second by m', and so on for all the equations, then adding the products, and (for brevity,) denoting $m(\mathrm{P}y-\mathrm{Q}x)+m'(\mathrm{P}'y'-\mathrm{Q}'x')+$ &c. by $\mathrm{S}m(\mathrm{P}y-\mathrm{Q}x)$, we shall have $\mathrm{S}m(\mathrm{P}y-\mathrm{Q}x)=0$, which is independent of the actions of the bodies on each other, for the actions of every two of them destroy each other, as in (e); in the same way by (a) and (c), we have $\mathrm{S}m(\mathrm{P}z-\mathrm{R}x)=0$, also by (b) and (c) $\mathrm{S}m(\mathrm{R}y-\mathrm{Q}z)=0$, which are independent of the actions of the bodies on each other, as before. Hence collecting the results, we have $\mathrm{S}m\mathrm{P}=0$, $\mathrm{S}m\mathrm{Q}=0$, $\mathrm{S}m\mathrm{R}=0$, (f); $\mathrm{S}m(\mathrm{P}y-\mathrm{Q}x)=0$, $\mathrm{S}m(\mathrm{P}z-\mathrm{R}x)=0$, $\mathrm{S}m(\mathrm{R}y-\mathrm{Q}z)=0$, (g); since these equations are independent of any actions of the bodies on each other, we shall suppose these forces to be neglected in forming the values of P, Q, R, P′, &c. which they involve. Again, if any body of the system is to be in equilibrium on any surface or line, by subjecting the body to these conditions, the resultant of all the forces which press the body against the surface or line, will be destroyed by the equal and contrary reaction; $\therefore$ we may neglect all such forces in forming the equations of equilibrium. Hence neglecting the forces which depend on the particular conditions of the system, and the actions of the bodies on each other, it is evident by (f) that the sums of the remaining forces (or forces foreign to the system,) decomposed in the directions of the axes of x, y, z must each $=0$, when the system is in equilibrium; where it may be observed in forming these sums, that if the forces which tend to increase the coordinates

are considered as positive, then those which tend to decrease them, must be considered as negative.

Again, by comparing (g) with (12) and (13), it is evident that the sums of the moments of the foreign forces to turn the system about the axes of z, y, x, must each $=0$, when the system is in equilibrium; where it may be observed in forming these sums, that if those moments which tend to turn the system in one direction are considered as positive, then those which tend to turn it in the contrary direction must be considered as negative. The equations (f) and (g), agree with the equations (m) and (n), given at p. 43, of the Mecanique Celeste; and if we are not greatly mistaken, they have been obtained from principles altogether more simple than those used by La Place, or by any other author with whom we are acquainted.

It may not be improper to observe that (g) are independent of any forces which act on the bodies in the directions of straight lines drawn to the origin of the coordinates. For let h denote the distance of m from the origin of the coordinates, and $m\mathrm{S}$ any force which acts on m in the direction of h, then we shall have S for the force which acts on a unit of m in that direction; and by decomposing S in the directions of the axes of x and y, we shall have $\frac{x}{h}\times\mathrm{S}$, $\frac{y}{h}\times\mathrm{S}$ for the components of P and Q which depend on the force S; $\therefore$ by considering these forces only, we have $\mathrm{P}y-\mathrm{Q}x=\left(\frac{xy-yx}{h}\right)\times\mathrm{S}=0$; hence we may neglect all such forces in forming (g).

Again, since (f) and (g) have been derived from (a), (b), (c), we may neglect any six of the equations contained in (a), (b), (c) and use (f) and (g) for the neglected equations; which with the remaining equations in (a), (b), (c), will make as many equations as there are coordinates, $x\ y\ z$, $x'\ y'\ z'$, &c. for all the bodies m, m', &c.

Hence we shall suppose six of the equations (a), (b), (c), to be neglected, and that (f) and (g) together with the remaining equations in (a), (b), (c), are used to determine the positions of m, m', &c.

Equilibrium of a rigid system.

We shall now suppose that all the bodies of the system are invariably connected together, or that it is rigid; then by considering

any three of its points which are not in the same straight line, the position of each point will depend on its three coordinates, ∴ nine coordinates will be necessary, to determine the situation of the three points, but three of these will be given in terms of the other six by means of the distances of the three points from each other, ∴ the distances of the three points from each other are equivalent to three coordinates, ∴ they are equivalent to three of the equations (a),(b) (c). Again, the coordinates of any body of the system are given in terms of the coordinates of the given points by means of its distances from the points, and of their distances from each other, ∴ the distances of each body from the three points are equivalent to its three coordinates, or to three of the equations (a),(b),(c); hence there remain but six undetermined coordinates, or but six of the equations (a),(b),(c), or neglecting these and using (f) and (g) instead of them for the reasons before given, we shall have (f) and (g) for the equations of equilibrium of any rigid system, and they are sufficient without using any of the equations (a),(b),(c); which is in conformity with what has been said of the equations of condition when considering systems in general.

We shall begin by supposing that the system does not contain any fixed point, also we shall suppose the forces to be positive, and that their directions are determined by the (well known,) algebraic rules for the signs of the cosines of the angles which we shall suppose their directions to make with the positive directions of the axes of x, y, z. Let then F denote the resultant of all the foreign forces which affect a unit of m, a, b, c the angles which its direction makes with those of x, y, z severally, F′ a', b', c' the corresponding quantities for a unit of m', and so on; decomposing the forces in the directions of x, y, z we have F cos. a, F cos. b, F cos. c, F′ cos. a', &c. to be substituted for P, Q, R, P′, &c. in (f) and (g), hence they become SmF cos. $a=0$, SmF cos. $b=0$, SmF cos. $c=0$, (h); SmF(y cos. $a-x$ cos. $b)=0$, SmF(z cos. $a-x$ cos. $c)=0$, SmF(y cos. $c-z$ cos. $b)=0$ (i); which are the equations of equilibrium when the system is free. If the system is to be in equilibrium about a fixed point to which it is firmly attached, then fixing the origin of the coordinates at the point, we shall have (i) for the equations of equilibrium of the applied forces. Put SmF cos. $a=$X, SmF cos. $b=$Y, SmF cos. $c=$Z, M=the mass of the system, MR$_,$=R=the reaction of the point supposed positive, and A B C for the angles which its direction makes with those of x, y, z; then decomposing R in the directions of

x, y, z we have R cos. A, R cos. B, R cos. C to be added to the first members of (h), hence they become $X+R\cos. A=0$, $Y+R\cos. B=0$, $Z+R\cos. C=0$; $\therefore R=\sqrt{X^2+Y^2+Z^2}$, (k), $\cos. A=-\frac{X}{R}$, $\cos. B=-\frac{Y}{R}$, $\cos. C=-\frac{Z}{R}$, (l), which give the magnitude and direction of the reaction of the point; but it is evident that the resultant of the applied forces equals the reaction of the point, and is directly opposite to it; $\therefore$ put A', B', C' for the angles which its direction makes with those of x, y, z, and we have $\cos. A=-\cos. A'$, $\cos. B=-\cos. B'$, $\cos. C=-\cos. C'$, $\therefore$ by (l) $\cos. A'=\frac{X}{R}$, $\cos. B'=\frac{Y}{R}$, $\cos. C'=\frac{Z}{R}$, (m), which give the direction of the resultant, after having found its magnitude by (k).

If F, F′, &c. act in parallel directions; then considering those which act one way as positive, and those which act the contrary way as negative, we shall have $\cos. a=\cos. a'=\cos. a''=$ &c. $\cos. b=\cos. b'=$ &c. $\cos. c=\cos. c'=$ &c.; hence (i) become $\cos. a\,Sm\,Fy-\cos. b\,Sm\,Fx=0$, $\cos. a\,Sm\,Fz-\cos. c\,Sm\,Fx=0$, $\cos. c\,Sm\,Fy-\cos. b\,SmFz=0$, (n). Supposing F, F′, &c. together with their points of application to be invariable, but the angles $a\ b\ c$ to be indeterminate, we have by (n) $SmFx=0$, $SmF\,y=0$, $Sm\,F\,z=0$, (o) which determine the center of the parallel forces: and by (k) their resultant $=SmF$, $\therefore$ by (m) $\cos. A'=\cos. a$, $\cos. B'=\cos. b$, $\cos. C'=\cos. c$; $\therefore$ the resultant is parallel to the component, and its magnitude is equal to the difference of the sums of the positive and negative components, and it is evidently directed the same way as the greater sum. Change x, y, z, x', &c. in (o) into $x-X$, $y-Y$, $z-Z$, $x'-X$, &c., then we have $SmF\,(x-X)=0$, $SmF\,(y-Y)=0$, $SmF(z-Z)=0$, which give $X=\frac{SmFx}{SmF}$, $Y=\frac{SmFy}{SmF}$, $Z=\frac{SmFz}{SmF}$, (p); which show (generally,) that the parallel forces have but one center. If in (p) we have $SmF=0$, $SmFx=0$, $Sm\,Fy=0$, $SmFz=0$, they will be under an indeterminate form; but by (p) we have $X'=\frac{Sm'F'x'}{Sm'F'}$, $Y'=\frac{Sm'F'y'}{Sm'F'}$, $Z'=\frac{Sm'F'z'}{Sm'F'}$, for the center of all the forces except F; now $mF=-Sm'F'$, $mFx=-S\,m'F'x'$, and so on, hence $X'=x$, $Y'=y$, $Z'=z$; $\therefore$ in this case any one of the forces is equal in magnitude to the resultant of all the

rest, and directly opposite to it, which are evidently the conditions of equilibrium of a free system, when acted on by parallel forces. If $\mathrm{S}m\mathrm{F}=0$, but the numerators of (p) are not $=0$, then evidently any one of the forces equals the resultant of all the rest, but is not directly opposite to it; $\therefore$ there is properly no center of parallel forces in this case, although it is usual to say that the resultant $=0$, and is situated at an infinite distance. If the forces F, F′, &c. have the same sign, and are equal to each other, (p) become $\mathrm{X}=\frac{\mathrm{S}mx}{\mathrm{S}m}$, $\mathrm{Y}=\frac{\mathrm{S}my}{\mathrm{S}m}$, $\mathrm{Z}=\frac{\mathrm{S}mz}{\mathrm{S}m}$, (q), which are the well known formulæ for finding the center of gravity of a system of bodies; the resultant of the forces $=\mathrm{F}\mathrm{S}m$ (=the weight of the system if F=gravity.) Put $\mathrm{S}m=\mathrm{M}$=the mass of the system, then by (q) $\mathrm{M}^2\mathrm{X}^2=(\mathrm{S}mx)^2=m^2x^2+m'^2x'^2+m''^2x''^2+$ &c. $+2mm'xx'+2mm''xx''+2m'm''x'x''+$&c.; but $2xx'=x^2+x'^2-(x'-x)^2$, $2xx''=x''^2+x^2-(x''-x)^2$, $2x'x''=x'^2+x''^2-(x''-x')^2$ and so on; by substituting these values we have $\mathrm{M}^2\mathrm{X}^2=\mathrm{M}\mathrm{S}mx^2-\mathrm{S}mm'(x'-x)^2$; hence and by (q)

$$\mathrm{X}^2+\mathrm{Y}^2+\mathrm{Z}^2=\frac{\mathrm{S}m(x^2+y^2+z^2)}{\mathrm{M}}-\frac{\mathrm{S}mm'((x'-x)^2+(y-y)^2+(z'-z)^2)}{\mathrm{M}^2}$$

(r); which gives the distance of the center of gravity from the origin of the coordinates by means of the distances of the bodies from the same point, and of their distances from each other; by finding in this way the distances of the center from three given points, which are not in the same straight line, its position in space becomes known; Mec. Cel. vol. 1. p. 45.

We will now suppose that the system is to be in equilibrium about two fixed points which are invariably attached to it. Let the points be denoted by the letters m and n, then suppose the origin of the coordinates to be at m, R its reaction, A, B, C the angles which the direction of R makes with the axes of x, y, z (as before,) R′ the reaction of n, A′, B′, C′ the angles which its direction makes with those of x, y, z; X, Y, Z the coordinates of n: then by including R and R′ among the forces in (h) and (i) they become $\mathrm{S}m\mathrm{F}\cos.\ a+\mathrm{R}\cos.\ \mathrm{A}+\mathrm{R}'\cos.\ \mathrm{A}'=0$, $\mathrm{S}m\mathrm{F}\cos.\ b+\mathrm{R}\cos.\ \mathrm{B}+\mathrm{R}'\cos.\ \mathrm{B}'=0$, $\mathrm{S}m\mathrm{F}\cos.\ c+\mathrm{R}\cos.\ \mathrm{C}+\mathrm{R}'\cos.\ \mathrm{C}'=0$, (s); $\mathrm{S}m\mathrm{F}(y\cos.\ a-x\cos.\ b)+\mathrm{R}'(\mathrm{Y}\cos.\ \mathrm{A}'-\mathrm{X}\cos.\ \mathrm{B}')=0$, $\mathrm{S}m\mathrm{F}(z\cos.\ a-x\cos.\ c)+\mathrm{R}'(\mathrm{Z}\cos.\ \mathrm{A}'-\mathrm{X}\cos.\ \mathrm{C}')=0$, $\mathrm{S}m\mathrm{F}(y\cos.\ c-z\cos.\ b)+\mathrm{R}'(\mathrm{Y}\cos.\ \mathrm{C}'-\mathrm{Z}\cos.\ \mathrm{B}')=0$, (t). which are the equations of equilibrium, between the applied forces and the reactions of the fixed points. Put

X, Y, Z, for the first terms of the first members of (s) severally, and D, E, F, for those of (t), then multiply the first of (t) by cos. C′ and the second by −cos. B′, add the products, and we have D, cos. C′−E, cos. B′+R′ cos. A′(Y′ cos. C′−Z cos. B′)=0, this compared with the third of (t) gives D, cos. C′−E, cos. B′−F, cos. A′ =0, (u), multiply (u) by R′ and substitute from (s), then we have F,X,+E,Y,−D,Z,+R(F, cos. A+E, cos. B−D, cos. C)=0,(v); this or (u), is an equation of condition that must be satisfied; for it is evident that (t) are not independent equations. Again, multiply the first of (t) by Z, the second by —Y, the third by −X, then adding the products we have D,Z−E,Y−F,X=0, (w), which is the equation of a plane passing through the origin of the coordinates, in which the fixed point *n* must be taken, it is easy to find the position of this plane by knowing D, E, F,, and it is evident by (u), that the reaction R′ is always in this plane; hence by assuming *n* in this plane, and taking *mn* for the axis of *z*, it is evident that (t) will be changed to $Sm\mathrm{F}(y \cos. a - x \cos. b)=0$, $Sm\mathrm{F}(z \cos. a - x \cos. c)+ \mathrm{R}'\mathrm{Z} \cos. \mathrm{A}'=0$, $Sm\mathrm{F}(y \cos. c - z \cos. b) - \mathrm{R}'\mathrm{Z} \cos. \mathrm{B}'=0$, (x). We may suppose *mn* = Z, to be a fixed axis, then by (x) $\mathrm{R}' \surd\overline{\cos.^2 \mathrm{A}' + \cos.^2 \mathrm{B}'} = \mathrm{R}' \sin. \mathrm{C}' = \surd\overline{,\mathrm{E}^2 + ,\mathrm{F}^2} \div mn =$ the reaction of the fixed axis (at *n*,) in a direction perpendicular to its length; also $\frac{\cos. \mathrm{B}'}{\cos. \mathrm{A}'} = \frac{\mathrm{Y}}{\mathrm{X}} = -\frac{,\mathrm{F}}{,\mathrm{E}} =$ the tangent of the angle which its direction makes with the axis of *x*; the perpendicular reaction at *m*, is also easily found, and likewise by the third of (s), we have the reaction of the axis in the direction of its length. Again, if R=0, there will be but one fixed point necessary, and the applied forces will have a single resultant which will pass through *n*, and be destroyed by the reaction R′; also (u) or F,X,+E,Y,−D,Z,=0, (y) is an equation of condition which the applied forces must satisfy in order that they may have a single resultant, supposing *n* to be a fixed point, in the direction of the resultant. But if the applied forces have not a single resultant, it is evident by what has been done, that they may be resolved into two resultants which are not in the same plane, in an infinity of ways; for we have seen how to find the two points *m* and *n* so that their reactions R R′ destroy the applied forces, ∴ they are directly opposite to the two resultants into which the applied forces are resolved; and it is evident that an infinite number of points, which destroy the applied forces like *m* and *n* can be assigned.

If there are three fixed points in the system to which it is invariably attached, supposing that they are not in the same straight line; then denoting two of them by m and n as before, and supposing p denotes the third point, R'' its reaction, A'', B'', C'' the angles which its direction makes with those of x, y, z supposing the origin of the coordinates to be at m, and using the same notation as before; we shall have $R''\cos. A''$, $R''\cos. B''$, $R''\cos. C''$ to be severally added to the first members of (s), and $R''(Y'\cos. A''-X''\cos. B'')$ $R''(Z'\cos. A''-X'\cos. C'')$, $R''(Y'\cos. C''-Z'\cos. B'')$ respectively to be added to the first members of (t); (where X', Y', Z' denote the coordinates of p;) and we shall have six equations, which with $\cos.^2 A+\cos.^2 B+\cos.^2 C=1$, $\cos.^2 A'+\cos.^2 B'+\cos.^2 C'=1$, $\cos.^2 A''+\cos.^2 B''+\cos.^2 C''=1$, will be sufficient to determine the reactions and their directions; the system being fixed in position in this case by the three points, as was formerly remarked. Again, the preceding results are easily applied to any solid, by using dm for any indefinite element of the solid x, y, z for its rectangular coordinates, and F for the force which is applied to dm, and a, b, c for the angles, which its direction makes with the axes of x, y, z, then using S for the sign of integration relative to the mass of the solid; or to conform to usage, we may change S into s, which is the ordinary sign of the integration of differentials.

Put $F\cos. a=P$, $F\cos. b=Q$, $F\cos. c=R$, change m into dm, and use s instead of S; then (h) and (i) become $sP\,dm=0$, $sQ\,dm=0$, $sR\,dm=0$, (A); $s(Py-Qx)\,dm=0$, $s(Pz-Rx)\,dm=0$, $s(Ry-Qz)\,dm=0$, (B); which are the formulæ that are to be used when the system becomes a solid, the integral sign s referring to the element dm; and the integrals are to be taken relative to the whole mass of the solid.

Art. VIII.—*On Shooting Stars.*—Communicated for this Journal, by Mr. Elias Loomis, Tutor in Yale College.

Every person of a reflecting mind must have often asked himself the question, what are shooting stars. The suddenness of their appearance, the rapidity of their motions, their brilliancy, the trains which they frequently leave behind them are well calculated to awaken curiosity; and in the absence of definite knowledge respecting them, it is not perhaps strange that we have been favored with an

abundance of speculation and crude conjecture. These speculations are by no means confined to the brains of the illiterate, but are recorded every where in Encyclopedias and Scientific Journals. Not content with stating what is *known* respecting shooting stars, or rather unwilling to acknowledge what is *not known*, almost every writer seems to have considered it incumbent npon him to amuse his readers with the creations of his own fancy. One sagely informs us that phosphuretted hydrogen rising from the surface of the earth in unbroken columns to very considerable heights, spontaneously takes fire at the top and burns rapidly downward, presenting the appearance of a falling star. Another speaks of them as Jack-a-lanterns rising high in the air, dependent upon the wind for the direction of their motions. This idea that shooting stars follow the course of the wind is very common, and appears at first view to furnish a plausible explanation of their motions. For we may easily suppose particles of phosphuretted hydrogen to be floating in the air; the difficulty is to supply the power which puts them in motion. But when we learn that these meteors are frequently more than a hundred feet in diameter, and that they move with a velocity greater than that of the earth in its orbit, the inadequacy of all such hypotheses to explain the phenomenon in question, must be at once conceded. Facts like these respecting their velocities and magnitudes, can be ascertained only from simultaneous observations by two or more persons at different stations; and hence it must be apparent that such observations furnish the only basis for definite knowledge on the subject. If at two stations, whose distance from each other is known, the apparent place of a meteor in the heavens is noted, it is clear that we have the means of determining its height from the surface of the earth; and if like observations are made both upon the beginning and end of the meteor's course, the length of its path is known, and hence having the time of its flight, we have also its velocity.—So obvious a method of arriving at some definite knowledge on the subject, it might be supposed would have been often resorted to. The fact however has been otherwise. Among the most extensive observations of this kind are those made by Professor Brandes of Leipsic; and as they are but little known in this country, it may be acceptable to some readers of the Journal, to be furnished with an abstract of them. They compose one of a series of tracts, entitled Unterhaltungen fuer Freunde der Physik und Astronomie. The following particulars respecting their author, are from the Conversations-Lexicon der neuesten Zeit und Literatur.

Henry William Brandes, at present Professor of Physics in the University of Leipsic, was born July 27, 1777, in Groden, near Hamburg, where his father was pastor. From 1786 to 1793 he received instruction in the high school at Otterndorf, where he was made acquainted with the elements of Mathematics. As however, his family circumstances held out no prospect of a literary career, he left the Gymnasium, in order to learn practically hydraulic engineering, under Woltmann, a director in this department. Here he completed his mathematical studies mostly by himself, and in 1794 and '5, under Woltmann's direction, he had charge of the works upon the island Newark, then inhabited only by six peasant families. Here the hermit life which he was compelled to lead, permitted him to pursue his studies at pleasure. Having no prospect of any official appointment, he went in 1796, by Woltmann's advice, to Gottingen, where he studied till 1798. He busied himself also in Gottingen, inasmuch as some appointment in hydraulic engineering still floated before him as his future aim, more with architecture, surveying, &c., than with the higher mathematics and physics, which he regarded rather as auxiliary studies. His connexion with Benzenberg, occasioned in 1798, the first observations of the latter on Shooting Stars. In 1799 and 1800 he gave in Hamburg, elementary instruction in Mathematics; and in 1801, on the recommendation of Woltmann, he received the appointment of Director of the dikes in the Duchy of Oldenburg. In 1811, he unexpectedly received a call as Professor of Mathematics in Breslau; and this station he continued to hold, declining mean time an invitation to Dorpat in 1818, until 1826, when he accepted a call at Leipsic, as Professor of Physics.

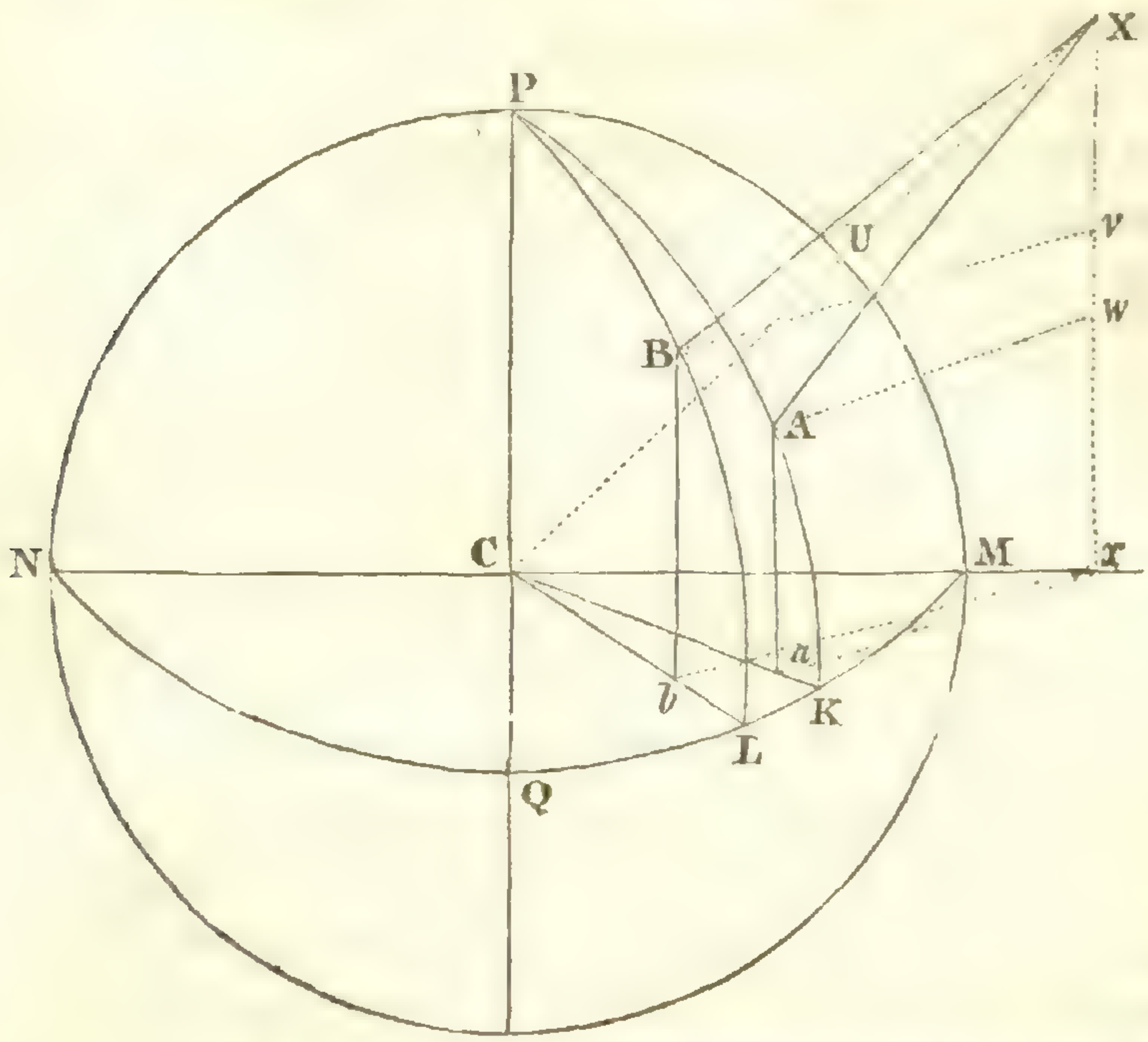
The observations of which it is proposed to give a brief account were commenced in April 1823, and continued, with interruptions, to the middle of the following October. The times of observation were from 8 to 10, or from 9 to 11 o'clock in the evening; the places were Breslau, Brechelshof, Dresden, Leipe, Mirkau, Trebnitz, Neisse, Brieg and Gleiwitz. Of these, Breslau and Gleiwitz were the most important, and those between which most of the coincidences occurred. Their distance from each other is about ninety English miles. Prof. Brandes with several of his pupils, made the observations at the former place. The number of meteors seen on the different evenings, was very various. On August 8th, sixty five were noted at Breslau; on August 10th, one hundred and forty were

noted in less than two hours, and Prof. Brandes remarks that they were obliged to leave many unrecorded. On most evenings however, the number was much less. In comparing the different observations, the first question which arises is, how shall we identify a meteor; i. e. how can we know that the same meteor was seen by two individuals. In the first place, after allowing for difference of longitude, the times should evidently agree; and it is unnecessary to compare any observations, where the times are not nearly coincident. Secondly, the lines of direction in which the observers saw the meteor must intersect. To determine the latter question, Prof. Brandes adopts the following simple expedient. Any three points are situated in the same plane, and consequently, a meteor must lie in the plane of a great circle, passing through the two places of observation. Rectify the celestial globe for the time and place of observation; mark upon its horizon the direction in which the two places are situated with respect to each other; mark also the two points to which the two observers referred the disappearance of the meteor. These two points must lie in the same great circle with the two former points on the horizon. Hold fast upon the two points on the horizon, a string passing through one of the apparent places on the globe, it should also pass through the other; and if the second apparent place varies considerably from the string, the two observations cannot have been made upon the same meteor, or the observations are so inaccurate as to be useless. This method with a large globe will detect an error of half a degree in assigning the place of a meteor; and greater accuracy than this cannot be expected in observations which are necessarily made without the aid of instruments.

When the times of observation, and the lines of direction agree, it is highly probable that the two observers saw the same meteor. Other circumstances may, however, increase this probability. The size of the meteor should always be noted, whether a star of the first, second, &c. magnitude; any peculiarity of color, train, &c. When all these circumstances are accurately noted, they furnish the means of deciding upon coincident observations, almost to a certainty.

In performing the subsequent calculations, Prof. Brandes employed the formulæ of Olbers. These formulæ are obtained in the following manner:

Let A be one, and B the other place of observation upon the earth, whose center is C, pole P, equator NQM, and X the observ-



ed point. From A,B,X drop perpendiculars to the plane of the equator, meeting it in a,b,x. Put A'=the Right Ascension of midheaven for B, B' its geographical latitude, R' its distance from the center of the earth; and let A'', B'', R'' represent the same for the point A, then is $Cb = R' \cos. B'$, $Ca = R'' \cos. B''$, and $aCb = A'' - A'$. Call the Right Ascension of the meteor as seen from B $= a'$, its Declination $= b'$, and let a'', b'' represent the same for the point A, then is $xbL = a' - A'$, $xaK = a'' - A''$; and if x represent the Right Ascension of midheaven for the point U where the meteor stood in the zenith, then is $xCa = x - A''$, $xCb = x - A'$. We then

$$\text{have } Cx = \frac{Cb.\ \text{sine}\ xbL}{\sin. Cxb} = \frac{Ca.\ \sin.\ xaK}{\sin. Cxa}, \text{ or}$$

$$Cx = \frac{R' \cos. B'.\ \sin.\ (a' - A')}{\sin.\ (a' - x)} = \frac{R'' \cos. B''.\ \sin.\ (a'' - A'')}{\sin.\ (a'' - x)}$$

whence we easily obtain

$$\text{tang. } x = \frac{R' \cos. B' \sin. (a' - A') \sin. a'' - R'' \cos. B'' \sin. (a'' - A'') \sin. a'}{R' \cos. B' \sin. (a' - A') \cos. a'' - R'' \cos. B'' \sin. (a'' - A'') \cos. a'}$$

Hence $x - A'$, the difference of longitude between the place of observation B, and the place where the meteor stood in the zenith, is given.

In the same manner we obtain $bx = \frac{Cx.\ \sin.\ xCb}{\sin.\ xbL} = \frac{R' \cos.\ B'\ \sin.\ (x - A')}{\sin.\ (a' - x)}$. Also $ax = \frac{R'' \cos.\ B''\ \sin.\ (x - A'')}{\sin.\ (a'' - x)}$, and it is evident that $Bv = bx$, and $Aw = ax$ being parallel with it. XBv is the apparent declination of the meteor seen from B, and $Xv = \frac{R' \cos.\ B'.\ \sin.\ (x - A')\ \text{tang.}\ b'}{\sin.\ (a' - x)}$. Put y = the latitude of the place where the meteor stood in the zenith, and we have $\text{tang.}\ y = \frac{xv + vX}{Cx} = \frac{\text{tang.}\ b'\ \sin.(x - A') + \text{tang.}\ B'\ \sin.\ (a' - x)}{\sin.\ (a' - A')}$. In the same manner $\text{tang.}\ y = \frac{\text{tang.}\ b''\ \sin.\ (x - A'') + \text{tang.}\ B''\ \sin.\ (a'' - x)}{\sin.\ (a'' - A'')}$

These two values of y should be exactly equal; but as the lines of direction are seldom given with such exactness as actually to intersect, these two values almost always differ somewhat, and this difference, if not too great, serves to shew the probable accuracy of the two observations; whereas, if the amount is considerable, it shews either that we have united too observations which are not correspondent, or that the observations are too loose to allow any confidence in the result.

Finally take ϱ the distance of the meteor from the center of the earth, we have $\varrho = \frac{Cx}{\cos.\ y} = \frac{R' \cos.\ B'\ \sin.\ (a' - A')}{\cos.\ y\ \sin.\ (a' - x)} = \frac{R'' \cos.\ B''\ \sin.\ (a'' - A'')}{\cos.\ y\ \sin.\ (a'' - x)}$; and if we here employ the two values of y, we may see how nearly correct we can regard the calculated height $= \varrho - R$.

The distance from the first place of observation, is $Bv \sec.\ b' = \frac{R' \cos.\ B'\ \sin.\ (x - A')}{\sin.\ (a' - x) \cos.\ b'}$; from the second $= \frac{R'' \cos.\ B''\ \sin.\ (x - A'')}{\sin.\ (a'' - x) \cos.\ b''}$.

A detail of the observations and the calculations for each meteor would probably possess little interest for most readers of the Journal. The more important results are contained in the following table. A few particulars respecting individual meteors are appended.

Table of the calculated Meteors.

Time.	Number.	HEIGHTS. Under 50 miles.	50 to 100 miles	Over 100 miles.	Direction in azimuth from the South point.	Angle with vertical.	Length of course in miles.
	1. Beg.		87.41				
May 2.	1. End.	17.14			62° West.	57°	131
	2. Beg.		67.74				
	2. End.		57.83		9° West.	82°	76
	3. Beg.	6.45					
May 7.	3. End.	6.45					1.8
	4. Beg.	4.6					
	5. Beg.		56.2				
May 10.	5. End.	38.25			135° West.	41°	23
	6. Beg.	44.7					
Aug. 4.	6. End.	27.19			77° East.	36°	22
	7. Beg.	34.1					
Aug. 10.	8. Beg.	41.47					
	9. Beg.	29.03					
	10. Beg.			138.7			
Aug. 11.	10. End.			145.6	75° West.	106°	27
	11. Beg.	34.56					
	11. End.	18.4			65° West.	72°	50
	12. Beg.		62.67				
	12. End.	34.1			60° West.	41°	38
	13. Beg.		64.51				
	13. End.	41.			17° East.	45°	32
	14. Beg.	44.24					
	14. End.	20.74			98° West.	14°	23
	15.	32.					
	16.		55.3				
	17. Beg.		90.32				
	17. End.		73.73		32° West.	22°	18
	18. Beg.	43.76					
	18. End.	35.48			14° East.	49°	14
Aug. 29.	19. Beg.		77.88				
	20. Beg.	48.84					
Aug. 30.	20. End.		58.06		22° East.	158°	10
	21. Beg.		91.24				
	21. End.		82.94		7° East.	82°	57
	22. Beg.	37.32					
Sept. 1.	22. End.		76.8		30° East.	135°	60
	23. Beg.		65.89				
	23. End.		65.89		65° West.	90°	18
	24. End.		74.				
Sept. 2.	25. End.	13.8					
	26. Beg.	23.96					
	26. End.	37.32			117° West.	129°	23
	27. End.	25.					
	28. End.	26.26					
	29. End.	39.63					
	30. Beg.						
	30. End.		94.92	129.	170° East.	55°	58
	31. Beg.	21.65					
	32. Beg.	18.4					
Sept. 11.	32. End.	24.42			106° East.	101°	32
	33. Beg.		83.87				
	33. End.		51.61		101° East.	31°	38
	34. Beg.		70.04				
Sept. 12.	34. End.		76.49		142° West.	96°	55
	35. Beg.		65.89				
Sept. 27.	35. End.	45.63			173° West.	24°	23
	36.			140.			
	37. Beg.		68.2				

Time.	Number.	HEIGHTS. Under 50 miles.	50 to 100 miles.	Over 100 miles.	Direction in azimuth from the South point.	Angle with vertical.	Length of course in miles.
	38. Beg.		65.43		51° West.	63°	23
	38. End		55.3				
	39.	45.63					
	40. Beg.		62.67		19° East.	53°	18
	40. End		52.07				
	41. End	18.43					
	42. End.		52.07				
	43. Beg		63.59		142° West.	47°	27
Oct. 7.	43. End.	44.42					
	44. Beg.		60.83		19° East.	30°	18
	44. End	46.54					
	45. Beg		62.79		10° West.	34°	36
	45. End.	34.1					
	46. Beg		50.23		151° West.	56°	18
	46. End	39.17					
	47. End.	39.17					
	48. Beg	43.78			71° West.	96°	73
	48. End		51.61				
	49. Beg.			about 270.		about 0°	180
	49. End		93.54				
	50. Beg.			120.	56° East.	68°	180
Oct. 8.	50. End		56.				
	51. End.		62.79				
	52.		about 60.				
	53.	25.8					
	54. Beg		54.38		80° West.	129°	18
	54. End.		65.43				
	55.			500.			
	56. Beg.			210.6		about 0°	96
	56. End.			114.3			
	57. Beg.	17.97			74° West.	52°	4
	57. End.	14.75					
	58. Beg.		58.52		61° West.	104°	23
	58. End.		64.51				
	59.	18.					
	60. Beg.		60.				
	61. Beg.		74.19		62° West.	55°	32
	61. End.		57.14				
	62 Beg.		70.04		135° West.	36°	23
Oct. 9.	62. End.		52.99				
	63. End.		61.29				

No. 2. Of remarkable size and a red light, equal to Venus in brightness. As this was seen about one hundred miles distant, reckoning its apparent diameter at only one minute, its actual diameter must have amounted to considerably more than one hundred feet.

No. 6. Duration somewhat more than one second. Velocity about twenty miles per second.

No. 30. Duration two seconds. Velocity twenty nine miles per second.

No. 43. A small fireball of which the train was observed by Brandes at Breslau, ten seconds. If we take its apparent diameter at only one minute, its true diameter must have been one hundred and twenty feet, and the train formed a cylinder from fourteen to eighteen miles long of the same diameter.

No. 50. Duration five seconds. Velocity thirty six miles per second. If we take its apparent diameter the same as that of Jupiter, its true diameter must have been eighty feet.

No. 56. This meteor stood in the zenith on the shore of the Baltic near the Gulf of Riga, and fell ninety six miles almost vertically downwards. The distance from Gleiwitz to this place where it stood in the zenith is four hundred and eighty miles, and the meteor might therefore have been observed from Gleiwitz almost to Lapland; and from Christiansand in Norway to Twer in Central Russia.

Of the thirty six observed courses, twenty six are downwards, nine upwards, and one meteor moved horizontally; thirteen courses differed from the lower vertical, less than 45°, fourteen are between 45° and a horizontal direction, eight between the horizontal direction and 135°, and only one inclined still more upward. Of the azimuths, nine are situated in the S. E. quadrant, fourteen in the S. W., seven in the N. W., and four in the N. E. These meteors appear to be subject to gravity, but at the same time to be impelled by some other power, which in some cases was sufficient to communicate a direction contrary to gravity. The prevalent direction in azimuth appears to be 55° West from South. For if we class together those which fell in the quadrant, in the middle of which 55° West is situated, we have fifteen between 10° and 100° W. azimuth, instead of which in the opposite quadrant, from 80° to 170° E. only three occur; one of the remaining quadrants has seven, the other nine. This observation, that notwithstanding the variety of directions, the one to the S. W. is predominant, leads us to the question, whether this is not merely a relative velocity to the earth which is itself in motion. A body actually at rest which the earth met in its course, would fall behind us very nearly in the direction which was opposite to the motion of the earth; and therefore if we fall in with bodies moving in all possible directions, this relative motion will be combined with the absolute motion, and the direction of this relative motion will be the predominant one of the former moving bodies.

It is then worth while to calculate the direction in which the earth was moving at the time of the preceding observations, and see if it agrees with the former direction of 55°W. azimuth. Prof. Brandes has made this calculation for each observation, and taking the mean of them all so as to allow each one such weight as the number of courses determined for the several evenings requires, he finds it to be 131° 50′ E. from the S. meridian; or the point to which the earth's

motion is directly opposed, lies in 48° 10′ W. azimuth; and if we now take this as the mean direction of the courses, we shall find in the octant whose middle is 48½° W., or which extends from 26° to 71° W., 9 courses; in the two next octants which extend from 71° to 116° W., and from 19° East to 26° West, 4 in one and 7 in the other; in the two middle octants which extend from 116° to 161° West, and from 19° to 64° East, 6 in one and 3 in the other; in the two more distant octants which extend, the one from 161° West to 154° East, the other from 64° to 109° E. two in one and three in the other; finally in the octant opposite the first direction, *not one*.

It appears therefore, so far as a conclusion is authorized from so small a number of observations, perfectly clear that this prevalent direction is owing to the motion of the earth.

The velocity of these meteors, is settled to be from 18 to 36 miles a second. As the earth advances with a velocity of about 19 miles per second, in accordance with the considerations now suggested, those meteors should move relatively the swiftest whose proper motion is directed toward the West, and those directed towards the East, should move slowest over the earth; whether this is so, cannot certainly be determined from these observations.

Art. IX.—*Observations on the Tertiary Strata of the Atlantic Coast*; by T. A. Conrad.

The importance of organic remains in determining the relative ages of strata, is very obvious, when we view those concomitant beds of sand and clay, extending from Cumberland county, N. J., through Delaware, Maryland, Virginia, and North Carolina, and which the geologist without reference to their zoological characters, would probably consider the product of one particular epoch, elevated above the level of the sea, by the agency of some revolution, which has simultaneously exposed the whole series of deposits; but nothing could be more fallacious, as an attentive consideration of the distribution of recent shells, and a comparison of those with the fossils of each deposit, together with a comparison of those of each particular locality abundantly prove. If the whole line of our coast, were suddenly exposed for some distance beyond low water mark, we should find a great uniformity in species, extending over many degrees of

latitude, the proportion of those inhabiting between the tropics, gradually increasing to the southward, until we arrive at the extremity of the Florida peninsula, which, swept by the Gulf stream, is supplied with most of the West Indian species. The fossils, if they had been exposed with this uniformity, might be expected to correspond in the recent species they embrace, with those of the opposite coast, as is partly the case in the newest tertiary strata; the species also would gradually assume a different general character, embracing more tropical species as the formations stretched to the south. The zoological characters of even the newest tertiary beds, are at variance with the phenomena we might expect from a sudden and universal elevation. Throughout the tract I have alluded to, a bed of the common oyster, (*Ostrea Virginiana*,) very frequently occurs, with a few other shells now common in our estuaries and lagoons, and embracing occasionally small fragments of extinct species. These last have evidently been washed out of the older strata beneath, and the conclusion is obvious, that the first upheave of the older strata in the open sea, has not elevated them all above the surface, but by exposing shallower portions of the bed of the ocean, a chain of lagoons or bays, as they are improperly called, was formed, in which the oysters accumulated, as they do at present in similar situations. The beds of these lagoons, have there been exposed, and wherever they occur, they will be found to overlie the oceanic reliquiæ of the medial Pliocene, having clearly been a more recent deposit. The organic remains below these are imbedded first, in the ascending order, in a lead colored clay, the thickness of which is undetermined, and next in sand, never exceeding fifteen or twenty feet in thickness. This alternation of clay or shelly marl and sand enclosing similar species is analogous to cotemporaneous strata in England; of the Apenines, and of Sicily. The clay or marl exhibits no trace of having been subjected to the action of violent currents, but the superincumbent sands always exhibit, more or less, evidence of such disturbance. In the newer Pliocene, angular fragments and water worn specimens of shells are found, and on the James river, in Virginia, the matrix of the medial Pliocene contains perfect and delicate fossils, but is itself, in many instances, little else than shells comminuted by attrition. I infer, therefore, that the upper strata have been deposited in much shallower water, and that the deep sea deposit of clay has been upheaved prior to the deposition of the former. The only locality I am acquainted with, where the clay does

not appear beneath the sand, is at Wilmington, North Carolina. The sands here rest upon secondary rocks.

The slight elevation of all our Pliocene strata above the level of the sea, confirms an observation of Lyell, that the newer Pliocene is found at great elevations only in the countries of volcanoes and earthquakes. Thus, remote as is our coast generally from the centre of volcanic disturbance, it has to a certain degree been affected by it; but an earthquake which might have raised the shores of Mexico a thousand feet above the former level, would probably affect our coast in a far less degree.

On the western shore of Maryland, between the Chesapeake Bay and Potomac river, are two classes of deposits besides the equivalent of the London clay or Eocene, the first of which lying most to the westward, contains fewer recent species than the other, and is well characterised by the gigantic *Perna maxillata*. This class of deposits appears also on the Eastern shore, but although the Perna and some other identical shells occur there, the most abundant species are remarkably dissimilar, the proportion of those existing and extinct being much the same. Intermediate to those on St. Mary's river, are strata, in which shells now inhabiting the middle and southern coasts are abundant, but some few extinct species are common to all these localities. So far as my observation has extended, the *Perna maxillata* is always associated with few recent species, and may be considered characteristic of the older of these Pliocene strata.

If our tertiary formations do not exactly correspond to those of Europe, still there can be no objection to using the terms there employed, to designate them, inasmuch as they are equally descriptive of, and applicable to, the American formations. The following diagram will show the relative age and the proposed names of all our Tertiary beds.

Newer Pliocene.	Nearly all recent species of the coast.
Medial Pliocene.	About 30 per cent of recent species.
Older Pliocene.	Perna maxillata. Very few recent species.
Miocene.	Probably wanting.
Eocene.	No recent shells of our coast and a few secondary species.

The localities of what I have here termed *Medial Pliocene*, are as follows: St. Mary's river, Maryland; Yorktown, Virginia; James river, near Smithfall, Va.; Suffolk, Va.

It sometimes happens that the proportion of extinct species of Testacea is much the same in two or more localities, whilst the shells generally are specifically distinct, and it is impossible to assign any limits to that portion of time which may have elapsed between the deposition of any of these when they occur near each other as is the case with those alluded to, but if the members of a formation are widely separated, the fossil must often differ specifically. We believe that little, if any, change has taken place among the inhabitants of the ocean since the dawn of their history, in the annals of recorded time, but formerly, as now, species may have been wafted by currents on the log, sea weed or other extraneous substance, and become naturalized on shores remote from their original localities. We must be content with our ability to classify the grand divisions in chronological order, without hoping to ascertain the periods of time which may have intervened between the minute subdivisions of formations. That lines of demarcation can be drawn between most fossiliferous strata by distinctive zoological characters, few will doubt, and between the two grand divisions of the tertiary series of this country, this line is so obvious and broadly marked, that he who runs may read, if he is at all acquainted with organic remains, for so far as a comparison of about two hundred Eocene fossils, with as many of the Pliocene, will enable us to decide, *no one species of shell is common to both, whilst the former contains a few secondary fossils.* These facts are the more interesting, as they are just the reverse of what has been remarked of the European equivalents.

In a late number of the Journal, my friend Mr. Croom, gives a very interesting notice of the "marl pits" on Mr. Benners' plantation, on the Neuse river, below Newbern. Since the publication of that article, Mr. Croom has politely sent me a collection of the organic remains of these "marl pits," which prove them to belong to the newer Pliocene era. They consist of the remains of land animals mixed with marine shells, which are numerous in species, vastly abundant, and nearly all referrible to existing mollusca of our coast; some of them are still brilliantly colored; and retain their natural polish; of sixty seven species, only five are extinct or unknown; only eight occur on the southern coast of Florida and in the Gulf of Mexico, and the remainder inhabit the coasts of the middle and southern states. I think it highly probable that these fossils are superimposed on the medial Pliocene, and that some of the extinct species are derived from older strata. A few specimens are water

worn, and may have been washed out of distant localities of the medial Pliocene. At all events, the mass of fossils consists of the most common shells of the middle and southern states, and have so recent an aspect, that most geologists would compare them with those of Italy, which Mr. Lyell cites as examples of his newer Pliocene. In these interesting beds, occur two fresh water shells, *Rangia cyrenoides*, Des Moulins, and *Cyrena carolinensis*,* which proves that an estuary, in which the waters were nearly or quite fresh, existed in such proximity to the beds of marine shells, that its products have been transported by currents into the sea, in proof of which I may observe that the fresh water genera are invariably much water worn. The contiguity of the land or shore of the Pliocene ocean is strongly marked by the remains of quadrupeds, which have been dug out of the "marl pits," in company with the marine testacea, and if I have been correctly informed, in some instances, encrusted by *Balani* and other sessile shells. Among these exuviae, the horns of a deer, and teeth of the mastodon, are conspicuous, and although it may be objected that such remains, like bowlders, may have been transported from a great distance, by violent currents, yet the fact of shells having attached themselves to the bones, and the entire absence of all quadruped remains in other marine deposits, lead to the supposition that they have been washed down the ancient channel of the Neuse, and that the shells must have existed either cotemporaneously with the mastodon, or after it became extinct. Mr. Lyell informs us of the occurrence of a bone breccia in Sicily, which he believes to be of more recent origin than the newer Pliocene. The occurrence, therefore, of facts proving the existence of the mastodon before or at the same time with the shells of the newer Pliocene era, will throw new light on the history of the latest formed Tertiary strata.

It is only in the newer Pliocene that we meet with such evidence of the proximity of the ancient coast to the fossil localities, or that we find any shells of fresh water origin or even any very decided proof of bays and estuaries. It is probable that several localities of the medial Pliocene, were formed in situations similar to the har-

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* It is worthy of remark, that these shells are the only bivalves living in Mobile bay, near Mobile, where the water is potable, and that although the Cyrena occurs in the waters of South Carolina, the Rangia has not yet been observed living in any situation north of estuaries of the Gulf of Mexico.

bors of Charleston and Newport, as the recent shells of those harbors accord remarkably with the fossils of the medial Pliocene; but the older Pliocene appears to have been of deep sea origin, deposited beyond all influence of currents setting from the rivers into the sea. The newer Pliocene on Mr. Benners' plantation exhibits some striking points of difference to the Potomac beds, in the enclosed organic remains, embracing a far greater number of species, a few of which are extinct or unknown, common also to the medial Pliocene strata; whilst not one of the lost species of the latter occurs in the newer sands and clays of the Potomac locality. The recent shells of the Atlantic, in a line east from the mouth of the Potomac, do not vary much from those of North Carolina, east of Newbern, and yet to contrast the two fossil localities alluded to, I will observe that the latter, contains forty species not found in the former, and also a much greater proportion of tropical shells.

List of fossil shells found at Mr. Benners': (Newer Pliocene.)

Crepidula fornicata, Lam.
——— plana, Say.
Cerithium.
Fusus cinereus, Say.
Fulgur carica, Say.
——— canaliculatus, Say.
Buccinum avarum, Conrad.
Terebra dislocata, Conrad,
Nassa trivittata, Say.
Natica duplicata, Say.
Fasciolaria mutabilis, Conrad.
Oliva litterata, Lam.
———.
Marginella.
Ranella caudata, Say.
Fusus 4-costatus, Say.
Vermetus lumbricalis, Lam.
Scalaria lineata, Say.
Bullina canaliculata, Say.
Arthemis concentrica.
Chama arcinella, Lam.
Chama ———.
Cytherea Sayana, Conrad.
Cytherea albaria, Say.
Venus cancellata, Lin.
Crassatella undulata, Say.
Arca ponderosa, Say.
——— transversa, Say.
——— *limula*, Conrad.
——— pexata, Say.
Tellina alternata, Say.
——— (new).
——— (new).
Sanguinolaria fusca, Conrad.
Mactra lateralis, Say.
——— solidissima? Chem.
——— tellinoides, Conrad.
Cardium magnum, Born.
Lutraria canaliculata, Say.
Pecten concentricus, Say.
——— purpuratus, Lam.
——— *eboneus*, Conrad.
Nucula limatula, Say.
——— proxima, Say.
Cypricardia arata, Conrad.
Anomia ephippium, Lin.

Pholas costata, Lam.
Venus *alveata*, Conrad.
Pectunculus pectinatus, Lam.
——— *circularis*, Conrad.
Cardita granulata, Conrad.
Amphidesma transversa, Say.
Lucina divaricata, Lam.
Strigilla carnaria, Turton.
Mysia rotundata?
Amphidesma inequale, Say.
Cardita tridentata, Say.
Corbula contracta, Say.
——— *cuneata*, Say.
Plicatula *marginata*, Say.
Cyrena carolinensis.
Rangia cyrenoides, Des Moulins.
Astarte concentrica, Conrad.
Nucula acuta, Conrad.
Panopea reflexa, Say.
Ostrea virginiana, Gmel.
Venus deformis, Say.

List of fossil shells of the Newer Pliocene on the Potomac.

Crepidula convexa, Say.
——— glauca, Say.
Fusus cinereus, Say.
Nassa obsoleta, Say.
——— trivittata, Say.
Natica duplicata, Say.
——— *interna*, Say.
Ranella caudata, Say.
Scalaria.
Turritella alternata, Say.
Arca transversa, Say.
——— ponderosa, Say.
Corbula contracta, Say.
Cytherea Sayana, Conrad.
Mactra lateralis, Say.
Mya arenaria, Lin.
Mytilus hamatus, Say.
Nucula limalula, Say.
——— *acuta*, Conrad.
Pandora trilineata, Say.
Petricola pholadiformis, Lam.
Pholas costata, Lam.
Sanguinolaria fusca, Conrad.
——— lusoria, Conrad.
Solecurtus caribæus, Blain.
Solen ensis, Lin.
Venus mercenaria, Lin.
Rangia cyrenoides, Des Moulins.
Ostrea virginiana, Gmel.

The species in the preceding lists printed in italics, have not hitherto been found recent.

The foregoing lists of species shew how much the fossils of synchronous strata may differ specifically, without being so remote from each other as to induce the naturalist to expect much diversity of species.

Other localities of the newer Pliocene in North Carolina have been identified by a series of fossils sent by Prof. Elisha Mitchell, of Chapel Hill, to the Academy of Natural Sciences. To this formation also, belong the beds of oyster shells in New Jersey, on the Eastern shore of Maryland, in Virginia, &c., and these were deposited exclusively in lagoons whilst the former class of shells are either of estuary or oceanic origin.

In a former number of the Journal of Science, Prof. Mitchell, has given some valuable observations on the Pliocene region of North Carolina, in which he favors the theory of an upheave from the ocean, which Mr. Lyell has since so successfully applied to all other strata embracing fossils of marine origin.

ART. X.—*Miscellaneous Notices*; by Lt. W. W. BADDELEY, of the Royal Engineers,—Quebec.

1. *On the conjectured buoyancy of boulders at great depths in the Ocean.*

TO THE EDITOR.—*Dear Sir*,—Among the many phenomena which serve to interest and perplex geological students, none are more striking than the formation and position of boulders, and it is highly probable that no cause, in the first instance, tends more to draw votaries into the labyrinths of this delightful science, than the silent eloquence of these mysterious masses. We who reside on this *new* and interesting continent, are particularly liable to have our conjectures kept alive respecting them, and it appears to me impossible to pass one of these travelled rocks, without feeling the momentary wish that it possessed the power of speech, and the inclination to gratify our natural curiosity concerning them.

It is not, however, my intention to take up your time with so superfluous a labor, as the discussion of the well known facts bearing upon the inquiry into the cause or causes of the distribution of boulders would be; but neglecting these, I wish to call your attention to the applicability of a fact to it, which, as far as I am aware, has not been pointed out before, in any publication, although I doubt not that it has occurred to many persons.

As long as it was maintained that water was incompressible, an opinion originating in the well known Florentine experiment; an augmentation in the specific gravity of sea water, as the result of pressure, could not be rendered applicable to the enquiry. But the effect of experiments, in recent times, has been to overthrow the Florentine doctrine in this respect, and to render it probable that the density of water, owing to pressure, increases in a ratio proportioned to its depth.

Now, if this be true, what is the amount of this ratio? Is it sufficient to give to the waters of the ocean, in their greatest depths, a

density equal or superior to that of rock? For, if this be conceivable, so is it that pelagian boulders are now floating about at great depths, in all latitudes, and, if now, then formerly; an admission which would much lessen the difficulty of accounting for their presence in all climes, and almost all postures? Thus masses of rock, when once detached from, or reaching the depths of the ocean, might float to the antipodes of the spot where they first commenced their journey, and indeed, continue to float, until driven by upward currents, or other operative causes upon the sides and summits of submarine hills and mountains, where they might become deposited, in consequence of their superior relative density compared with that of the water they are *now* in, after having undergone the rounding which they would be likely to meet with, in the interim, from erosion and attrition.

This conjecture, (for it is nothing more,) will not be considered absurd, I think, when it is recollected that the compressibility of sea water has been proved by Perkins, and others, and is now generally admitted, and that the mean depth of the ocean, although unknown, must be considerable, some writers making it between two and three miles, while one of them, (La Place*,) considers it to be as high as twenty five. In short, it appears to me, that although much is wanted in the way of experiment, to determine this interesting question, what is positively known respecting it, favors the conjecture now submitted. Should you be of the same opinion, perhaps the well earned influence you possess in the scientific world, will be exerted to impress upon those, having the opportunity, the importance of ascertaining the relative temperature, density, and saltness of the ocean at various but measured depths, with the view of obtaining data sufficient to give an appropriate answer to the following question.

Given the Sp. gr. of a boulder (2.6) at the level of the ocean, what would be its Sp. gr. in relation to the water it is immediately surrounded by, if five miles below the surface? and what is its ratio of decrease?

2.—*Discovery of Gold in Lower Canada.*

3.—*Water Lime made from the rock of Quebec.*

Gold.—I have to inform you of two interesting facts, which have been lately ascertained respecting Quebec and its vicinity. The first is that native gold has been picked up, about thirty miles to the

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* "Not exceeding ten miles—more generally admitted not to be over five."—*Bakewell, 2nd Am. Edit. pa.* 4.

southward of this metropolis; it was met with, in a small stream running into the Chaudiere, and over a region, as I suspect, (for I have not visited the *precise* locality,) of talcose slate. A similar specimen was found in the same neighborhood several years ago. That in question is of a flat ovate form, weighs 10.63 grains, and has a sp. gr. of 15.7. The geological associations of this ore appear to be analogous to those of the Russian and American localities, and when we consider them all, additional probability is given to the conjecture, expressed by Professor Eaton, at page 52, No. 1, Vol. 18 of the American Journal of Science.*

Water Cement.—The second fact I have to communicate is, that our "Black Rock" which you have so well described in your tour, affords by the usual process, an excellent water cement. I have long suspected from its mineralogical characters, that this might be the case, and indeed several years ago, some experiments were made to ascertain the fact, but owing, I think, to not having reduced the rock when burnt, to a sufficiently fine powder, they failed. Meeting subsequently with a work on water cements, by Col. Pasley, R. E. in which the precaution is pointed out particularly, I was induced to repeat the experiments, (observing this precaution,) and the success was complete.

I have therefore, now, the pleasure of announcing, that with the exception of certain non-calcareous strata, readily recognized by their ferro-aluminous aspect, together with a few which are too calcareous, the whole of the "Black Rock" of Quebec affords, by burning, and grinding to an impalpable powder, a water setting cement, of an excellent quality, the adhesion of which, between the surfaces of two bricks has been found sufficient, after twenty days, to support upwards of four hundred and fifty pounds, while its hard-

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* It is worthy of notice, that in the neighborhood of the place where the gold was found, two or three Canadian peasants have been mining for several years past. About the year 1825, I visited the scene of their operations, and found a shaft, ten feet cube, sunk in talcose slate, the predominating rocks at hand being of serpentine. I have lately been informed that the depth of this shaft, is now upwards of fifty feet. At the period of my visit, silver was said to be the object of search, and presuming that they had mistaken the deceptive lustre of the silvery talc, for that of this metal, I endeavored to dissuade them from so ruinous a pursuit. Nothing has yet transpired as to their success, which is generally considered not to have been encouraging, and yet it is scarcely conceivable that they would persevere through so many years, without being stimulated to do so by some substantial return, a consideration, which joined to what is stated above, renders it not improbable that they have met with some small deposits of gold.

ness is about equal to that of fluor. Fragments, taken indiscriminately from all portions of the rock, afford also a water cement, but one probably, of inferior quality. However, the discovery, simple as it is, is of too recent a nature to allow of my saying much beyond the mere fact.

ART. XI.—*Account of the Caroline Islands by the Russian expedition for exploring the Russian Coasts of Asia and America. From the Bibliothèque Universelle, Juillet*, 1834.

IT will be remembered that in 1826, the Russian Government fitted out two *corvettes*, the *Moller* and the *Seniavine*, to explore these regions so little known, and so dangerous to navigators, on account of the numerous islands they contain, as well as for the purpose of describing the natural history of that interesting part of the world. The expedition was entrusted to the command of Capt. LUTKE; and C. H. MERTENS was the chief naturalist. Two draftsmen of distinguished merit, M. M. KITLITZ, and POSTELS, were attached to the expedition. It has brought home fine collections in zoology and botany, which it is expected will soon be figured and published under the direction of the academy of St. Petersburgh.

Before giving some account of the only memoir relative to these voyages, we shall briefly notice the history of its author, MERTENS, who, unfortunately for science, died soon after his return to St. Petersburgh. He was born at Bremen, May 17, 1796. His father was director of the school of commerce at Bremen, and was one of the first botanists of Germany. He had devoted himself particularly, and with the most remarkable success to the study of the Algæ, and although he had never published upon the subject, yet he was the principal regulator of this complex department. At the moment when he was about to publish his algology, the fruit of forty years labor, an accident deprived him of his manuscript. He died in 1831, about one year after his son, who gave promise by his abilities of sustaining the reputation of the family. The son commenced his career when quite young, by enlisting as a soldier, in the war, in which Germany defended its nationality against France; and he afterwards travelled through various countries, finally fixing himself in Russia, and renewing the pursuit of natural history, to which his

father had directed his attention in the days of his childhood. He became a member of the Academy of Sciences of St. Petersburgh, and one of the directors of its museum. He never had time to publish any farther account of his voyage round the world, than the notice of the Caroline Islands, from which we here make a few extracts.

Caroline Islands.—They are situated to the south of the Archipelago of the Larrone, as far as 2 or 3° of north latitude, from the Palaos islands to the isle of Ualan, and over a space of about 30° of longitude, between 134° and 164° east from Greenwich. These islands are generally based on coral, but have a variety of soil and population. They consist of more than four hundred islands, which are arranged in forty six groups, of which Captain LUTKE visited twenty six. They are distinguished into high and low islands; the most elevated rising to the height of three thousand feet above the level of the sea. The low islands are the most numerous. The principal vegetable productions of these islands, are the cocoa-nut tree, and three or four other palms, the bread fruit tree, which is the principal food of the inhabitants, the pandanus, many aroides, the bananas, figs, the barringtonia with superb flowers, the sonnerata, which often lives quite in the salt water, and the calophylium so remarkable for the beauty of its leaves. No ferocious beasts, or venomous serpents are known; and the climate, from the proximity of the sea, is remarkable for its invigorating freshness. The inhabitants are represented as possessing an amiable character, excepting those of the high islands, who are addicted to war. The former of these are of a stature rather above that of the Malays generally, being about five feet, ten inches. They are active, and possessed of a prepossessing physiognomy. Their hair is thick, and of a fine black chesnut color; forehead high, although retreating; nose distinct in its shape, though large and flat; mouth very large; lips thick; teeth of an ivory whiteness; eyes much cleft, and furnished with beautiful eye-lashes; the temples compressed; the chin prominent, with a beard sometimes thick, though usually not full. These islanders have generally been included within the Malay variety, from which, however, a mere *coup d'œil* is sufficient to distinguish them.

Our first interview with the inhabitants of the low islands, took place in the Lougounor group. As soon as we arrived in sight of the islands, we saw their canoes pulling off to meet us. Having come up with the Seniavine, which was lying to. they took down their sails, hailed us, accompanying their words with signs, signify-

ing their wish to come on board our ship. Scarcely was a rope thrown them, with which to make fast, before all who were in the first canoe, except two, who staid to watch it, were on board,—jumping upon the deck, without manifesting the slightest embarrassment, or the least fear or distrust. The most of them were naked, except a girdle about the waist. Many were furnished with a large pyramidal hat, made from the leaves of the pandanas, and which completely protected them from the sun. Necklaces of shells, or flowers, or made from the cocoa-nut shell, flowers in their hair and ears, were the sole ornaments of their dress. They manifested the greatest pleasure in mingling with us, laughing with the utmost glee for joy. They took an interest in whatever they beheld, and especially in whatever related to the vessel and to navigation. We saw the chiefs of these islanders give orders to take all the dimensions of the vessel; they examined with care the direction of the sails, and collected all possible information respecting our ship.

Commerce was immediately agreed upon between them and ourselves. They brought cocoa-nuts, fish, shells, various articles of their costume, fishing apparatus, bows, arrow root, poultry, &c., which they offered in exchange for articles of European manufacture. Iron was preferred before every thing else, especially knives and scissors, which appeared to them to possess an inestimable value. They appreciated very highly also, needles, but what most excited their admiration was the hatchet. Various trinkets, glass pearls, mirrors, ribbands, handkerchiefs, attracted particularly their attention and were received with delight. We had occasion often to remark that they preferred useful articles to such as were merely ornamental.

They discovered no fear in descending into our cabins, where our occupations particularly attracted their attention. They were fond of seeing us paint, and examine with attention, the productions of their islands. On first beholding a looking glass they were struck with astonishment, and could with the greatest difficulty be made to believe that what they saw in it was their own image. When seated at the table with us, they behaved with the utmost propriety, making use of knives, forks, and spoons. The soup and all the other dishes we offered them were quite to their taste, often pronouncing them *mammal*, which signifies good. Sugar, biscuit and rice were considered delicious; coffee delighted them much; but spirits and even wine were tasted with perfect disgust. Decanters of glass, transpa-

rent as the water they contained, excited in them more astonishment than any thing else in our possession.

It is impossible to find more good nature than among these islanders; completely ignorant of the use or the value of the articles offered to their view, their first wish was to handle them. It may, therefore be imagined how eager they were to touch the sextants, watches, &c.; but a simple caution was necessary to check them, and this would suffice to cause them to inform the absent, respecting the forbidden articles. They were allowed the most perfect licence on board the vessel, going through the cabins at pleasure, and yet they never abused the confidence we reposed in them.

They made us acquainted with their chiefs at the first interview, towards whom they observed the most perfect submission; but for the rest, it was impossible to remark a distinction of rank among them: they seemed to be all of the same rank, nor did they manifest any particular deference towards their chiefs. They were very pressing in their invitations to us, to visit them, and to pass some time on shore. As soon as we had come to anchor in their bay, we were besieged with canoes. The male population came to examine our ship, but we allowed only the chiefs, and a few others to come on board. The most perfect gayety reigned among them all. Although we have frequently seen these islanders, we have never witnessed any quarrels among them. Always gay, always contented, they seemed to have preserved their innocence and naiveté from their first infancy. They never brought their wives or any females on board. The whiteness of our skin attracted their admiration; and they obviously preferred it to their own complexion. They conducted us on shore with the greatest cordiality, and introduced us to a large house, where were assembled the chiefs; they spread mats for us to be seated, and offered us the rarest, and the best things they possessed for our refreshment. The building was a large roof, supported by pillars, and covered with cocoa-nut leaves. The front side of the building, as well as its floor, was completely covered by persons; in its center was a kind of hearth for fire, and in the interior were perceptible numerous partitions, or screens, behind which were deposited fishing apparatus, &c. The chiefs accepted with pleasure the presents we offered them, and gave us in return, mats, cordage, and cocoa-nuts.

When we commenced our researches respecting the natural history of the island, all the youth offered us their services; but when

we requested not to be incommoded by such a troop of children, they quitted us immediately, except a few persons for guides. No person appeared to have the least desire to know where we were going. At first, they manifested the greatest fright at the report of the gun; but they gradually became accustomed to it. Our guides, in taking us across the island, on finding that we were desirous of knowing the names of the different plants, and other objects which we met with, did not fail to give us their names, and this without our asking them. Their joy was very great on perceiving afterwards that by the aid of our notes, we retained the names. They would oblige us to undergo an examination, which occasioned the utmost glee, especially whenever we had fallen into any error. They were particularly delighted when we had learned to count as high as ten in their language. Those objects in which we took the most interest, were explained to us with the greatest care, though unfortunately, we could not comprehend the details which they took the trouble to communicate; the useful or noxious properties of plants, the good or bad qualities of animals, were mentioned with the greatest eagerness. The various plants that I collected, were carried by them with all the care imaginable. They mounted the highest trees to gather for us the flowers, or threw themselves into the breakers to collect whatever they thought would be agreeable to us. They conducted us every where, and took care especially to lead us by the houses of the chiefs, who received us with pleasure and regaled us with cocoa-nuts.

We were surprised, notwithstanding the entire confidence they evinced in us, at not being permitted to see the females. We had perceived already that they were concealed from our view, and that we had even been obliged to shun in our excursions, the houses in which they lived. If by accident we happened to approach them, our guides employed all their power to turn us aside, by exclaiming the word *farak! farak!* which had the effect of obliging us to hold our ears. There was, nevertheless, in the manner they took to induce us to alter our course, so much of good nature, that it was impossible to be provoked with them, although they still kept up their interjections.

We found every where the same people upon the other groups of the low islands, as those we visited at Lougounor; the same hospitality, the same good nature, and the same gayety. But in none of these groups did we observe the lascivious manners, which are said to characterise, in general, the islands of the Pacific. The long

voyages which these islanders undertake, their frequent visits to their neighbors, as well as their excursions even to the European colonies, have not changed the remarkable innocence of their manners, or taught the crime of theft. The inhabitants of the Auléai group, especially those of the island Feiss were less severe respecting the intercourse of their females with us; but in no instance, was the slightest impropriety of conduct detected in them.

The expedition found on the Caroline islands, a young Englishman, by the name of William Floyd, who had been left by a whale ship, and who had lived there eighteen months. Capt. LUTKE took him on board, and learnt from him the following particulars relating to the manners of these islanders.

A single chief reigns over the *Fananou* and the *Mourilleu groups*; and the twenty islands composing them pay him an annual tribute of bread fruit, cocoa nuts, mats, &c. What is very surprising, is, that one island of the Fananou group is exempt from this tribute, and that its inhabitants disdain all communication with their neighbors. Although the king fishes himself, yet his people reserve for him the finest fish they take, and they support him in the most ample manner. Whatever he commands is law; and yet the king like the subject, is subject to laws. If he wishes, for example, to marry a second time, he is obliged to pay the tribute demanded of all who enter anew into this relation. Neither can he take a wife without her consent.

The aged men are generally chosen as the judges. To be reproved by these, is considered as the severest punishment that can overtake a person. When the case is one of great difficulty, they have recourse to the king, who obtains considerable advantage from their appeals, for the parties are obliged to make him handsome presents when the trial is over. It is necessary to add, for the honor of the king, that he exerts himself to prevent the quarrels and dissensions which are liable to occur among his people, without regard to his personal interest in the affair. The succession of the king is not hereditary. At his death, the people invite his brother to take his place, and in case he has no brother, the dignity is conferred upon one of the best friends of the deceased. The person chosen, has no right to decline the office. The wisest person is always selected in preference to the most wealthy, and the most powerful.

The men rise very early in the morning, and their first business is to repair to the shore, to wash, bathe, and rinse the mouth. It is un-

lawful for them to employ fresh water for this purpose, and they are persuaded that whoever neglects this custom, will be unsuccessful in taking fish. The females bathe in like manner, at another place, quite by themselves.

Their language is not difficult to learn, at least, that employed among the men. But it is difficult to have in the mind constantly, the numerous expressions and words which it is unlawful to employ in the presence of females. Nothing proves however, more clearly, than this usage, the great respect paid to females among these islanders. The inhabitants, in general, are extremely fond of talking; their evenings are passed ordinarily, in relating stories, or adventures which they have experienced in their voyages. They describe with delight the new islands they have visited, or seen, their inhabitants and productions, how they have been received by the people, what they have seen in the Spanish colonies, particularly their vessels. These conversations are often protracted until midnight, and it is by them, that they maintain the exact knowledge they have of the different islands which compose the Caroline Archipelago.

MERTENS gives numerous details respecting the different methods of fishing employed by these people, and upon their mode of navigation. He also describes their musical performances and mode of dancing. They have a musical fête once in two years, for which the greatest preparations are made. They apply themselves to this art with the utmost attention. It is the occasion of much voyaging from one island to another. If for example it happens that a young man wishes to display his musical talents on a distant island, he does not hesitate to embark for the place, sure of being received with a hearty welcome. It is the case that appointments are made for these fêtes a long time beforehand. In the year that we discovered the Mourilleu Islands, a part of the Islands Setoas, Sonek and Tametam, had engaged to go in the month of June of the present year, to the Island Fananou, the residence of the King of the group, although distant about two hundred miles, solely for the purpose of engaging in one of these entertainments. It was stipulated that seventy canoes should be employed in the voyage and that each one should contain five singers. On these occasions the singers of both sexes, dress themselves with the utmost care, being decked out with mantles made from the fibre of banana, with wreaths and necklaces of flowers, shells, and painted wood, with feathers, &c. The fête begins as follows: two or three men approach with cere-

mony to the house appropriated for the celebration. Having entered, they begin to sing. At this signal, all the other male performers repair to the same place and array themselves upon one side of the building. Next come the female part of the choir, to whom the opposite side is assigned. The whole island now assembles, men, women and children. The men open the concert in which the females gradually unite. At the commencement all are seated, but they soon rise to join in the dance. The entertainment lasts for three or four hours, when the females withdraw, after which the men prolong the fête; and do not quit the house until they have partaken of the best refreshments the island is capable of affording. Besides these great entertainments, which require so much preparation, the islanders often assemble in small collections to sing and dance, especially during the summer months, when there is the greatest abundance of fish.

Art. XII.—*Miscellanies.*—Recent discoveries in Chemistry and the Chemical Arts.*

Translated and abridged from Foreign Journals; by C. U. Shepard.

1. Two Organic Acids in mineral waters.—2. Memoir on Tannin.—3. Formic Acid.—4. Phosphovinic Acid.—5. New compounds of Platina.—6. Transformation of vegetable substances into a new principle.—7. Créosote.—8. Method of determining nitrogen in organic compounds.—9. Oxide of iron an antidote for arsenic acid.—10. Titanium one of the constituents in primitive rocks.—11. Volatibility of Titanium.—12. Preparation of Iodic acid.—13. To obtain manganesiate of Potash.—14. Memoir on Tellurium.—15. Hydrate of Phosphorus.—16. Phosphuret of Nitrogen.—17. Hyper-iodic acid.—18. Boracic acid of Tuscany.—19. Manufacture of carbonate of soda.—20. Preparation of artificial Ultra-marine.—21. Cementation-copper in Spain.—22. Roasting of copper ores.—23. Reduction of chloride of silver.—24. Preparation of the Purple of Cassius for staining glass.—25. New method of producing heat.—26. Method of assaying manganese ores.—27. New method of preparing Zaffre.—28. Gas lights.—29. A new green Pigment for artists.—30. Improvement in the manufacture of sealing wax.—31. Filtration.—32. Purification of water.

1. *Two Organic Acids in Mineral Waters*, by Berzelius. (Ann. de Ch., t. 54, p. 219.)—Berzelius has found in the water of Porla, two electro-negative organic principles to which he has given the name of *crenic acid* (from κρηνη, *source*) and to the other

* Inserted thus early that they may not be excluded by the pressure of regular articles.—*Ed.*

that of *apocrenic acid*, because it is formed from the first. They form very probably, that ingredient common to all mineral waters, which has hitherto been called extractive matter. The water of Porla, although coming from a very abundant source, is so charged with it as to be yellow. The contact of the air causes the water to deposit an ochreous, brown precipitate, which contains the basic crenate of the peroxide of iron, together with the apocrenate. The acid is very easily separated from the ochre; and BERZELIUS believes that the ochres of most chalybeate waters might be employed like the bog iron ore, although they would be less rich. It is necessary to boil the ochre in a solution of caustic potash until the oxide of iron, instead of forming a fine powder which passes through the filter, presents flocculi of the hydrated oxide of iron. The liquid, which is then filtered, is of an intense brown color, and is saturated slightly to excess with acetic acid; afterwards acetate of copper is added to the solution as long as it occasions the brown precipitate. If the precipitate is whitish and remains so, a little more acetic acid is added. In this way the apocrenate of copper is separated. The filtered fluid is saturated with carbonate of ammonia, of which a slight excess is useful, and afterwards acetate of copper is added, so long as a greenish white precipitate is formed. It is the crenate of copper, the quantity of which is perceptibly augmented by maintaining the fluid at a temperature of 60° or 80° C. It is thrown on the filter and washed. Each precipitate is afterwards treated with water and decomposed by sulphuretted hydrogen. If too much water is employed, a brown liquid is obtained, which will not filter. The liquid, cleared by the filter of the sulphuret of copper, is evaporated *in vacuo*, to dryness. The crenic acid yields an extract of a deep yellowish brown color, which dissolves in alcohol. There remains, commonly, some crenate of lime, which is soluble in the water. The alcoholic solution evaporated *in vacuo*, leaves the crenic acid, retaining still a small quantity of the apocrenate of lime. In order to separate this salt, the acid is dissolved in water, and acetate of lead is added drop by drop, so long as the precipitate is brownish. It is then filtered, basic acetate of lead is added, and the precipitate is decomposed by sulphuretted hydrogen. The separated acid gives to water a yellow tint, and leaves in the vacuum a perfectly transparent yellow mass, without the least appearance of crystallization; but after complete desiccation, it is of a deep yellow, and appears crystallized at first, but is only traversed by parallel fissures. The acid is destitute of odor; applied to the tongue, it communicates a

pungent acid taste, becoming astringent. It reacts strongly upon turnsole. Exposed in solution to the air, it grows brown, and gives rise to apocrenic acid. It is soluble in water and in absolute alcohol, in every proportion. Its salts with the alkaline bases, resemble extracts; and are insoluble in absolute alcohol, but become more and more soluble in it, in proportion as it contains water. The ammoniacal salt becomes acid during evaporation. These salts become brown very soon from the action of the air, converting them into apocrenates, which may be easily separated by means of gelatinous alumina. The crenate of potash yields carbonate of ammonia by distillation. The crenates with an alkalino-earthy base are also slightly soluble in water, and dry in a layer, like varnish. The crenic acid precipitates the acetate of lead of a slightly yellowish color, and the acetate of copper of a clear green color; it yields a soluble salt with the protoxide of iron, and an insoluble one with the peroxide, but which dissolves in ammonia. It precipitates also the neutral sulphate of iron, the precipitate being of a whitish, or greyish red. The nitrate of silver gives likewise, a precipitate which soon becomes purple, and is perfectly soluble in ammonia. If only a small quantity of the nitrate of silver is added to the crenate of potash, the precipitate does not appear, because a double salt is formed.

The apocrenic acid is brown and resembles a vegetable extract; its taste is purely astringent; it is slightly soluble in water, but dissolves in a solution of crenic acid; it is more soluble in absolute alcohol than in water, although the alcohol does not act immediately upon it. It is almost entirely precipitated from the aqueous solution by the ammoniacal salt in flocculi of a deep brown color, resoluble in an abundance of water. Its compounds with the alkalies are perhaps neutral, of a brownish black color, resembling extracts, and insoluble in alcohol. It expels acetic acid from its combinations; it is more soluble likewise, in a solution of acetate of potash, which acquires by it the property of reddening turnsole. The ammoniacal salt acquires also this property by evaporation. The salts of baryta, of lime and of magnesia are very slightly soluble. The earthy and metallic salts are in general insoluble, with the exception of that formed by the protoxide of iron. The salt of oxide of copper dissolves little by little in washing; the solution has a metallic taste and leaves on evaporation a brown varnish. The apocrenic acid contains nitrogen like the crenic acid.

These two acids are produced by the decomposition of vegetable substances. The crenic acid and an acid resembling the apocrenic,

are found in rotten wood. Bodies analogous to these two acids are obtained when charcoal, soot, &c. are treated with nitric acid, and the product with an alkali. It is during this treatment with the alkali, that they are formed. They have a strong resemblance to the crenic acid; and BERZELIUS supposed at first, that there was no difference between them, but he afterwards found one, actually to exist.—*Ann. des Mines.*

2. *Memoir on Tannin, Gallic, Pyrogallic, Ellagic and Metagallic Acids,* by PELOUZE. (Ann. de Ch., t. 54, p. 337.)—Tannin is easily obtained in a state of purity, by the following process: The apparatus consists of a long and strait *allonge* resting upon a common decanter and terminating at its upper part by a glass ground stopper. A mesh of cotton is first introduced into the socket of the allonge, and upon it, the nut-gall reduced to a fine powder. The powder is slightly compressed, and when its volume is equal to half the capacity of the allonge, it is filled with the sulphuric ether of commerce. The apparatus is imperfectly corked, and left to itself. The next day the decanter will be found to contain two distinct strata of liquids; the upper one very light and fluid, the lower one much more dense, of an amber color and a syrupy appearance. The nut-gall is not removed so long as the volume of the lower liquid increases. When this has ceased, the two fluids are poured into a funnel, whose beak is stopped by the finger. After a few minutes repose, the lower stratum is run off into a capsule, and the upper one is put aside for distillation, in order to extract the ether, of which it chiefly consists. The heavy liquid is washed repeatedly in pure sulphuric ether, and afterwards placed in a stove or under the receiver of an air-pump. It disengages abundantly the vapor of ether and of water. The residue augments very sensibly in volume and leaves a spongy crystalline substance, very brilliant, sometimes colorless, but more frequently of a slightly yellow tinge. This is pure tannin whose astringency is extreme and devoid of any other mixture of a bitter taste. By this process, one hundred parts of nut-galls, afford thirty to forty parts of tannin, which is always perfectly pure.

The theory of the operation is as follows: of all the ingredients of the nut-gall, the tannin is the most soluble in water; consequently when aqueous ether is brought in contact with the finely powdered nut-galls, the water of the ether and a certain quantity of the ether, forms with the tannin a very dense syrup, which is

gradually forced down the allonge by the superior stratum of ether, which operates in this case like a piston.

Pure tannin is colorless and without odor. It is largely soluble in water, the solution reddening turnsole. It decomposes the alkaline carbonates with effervescence, and forms with most of the metallic solutions, precipitates which are true tannates. The proto-salts of iron are not decomposed by it; but it precipitates abundantly, and of a deep blue color, the per-salts of this metal. Alcohol and ether dissolve tannin, but much less perfectly than water. It is incapable of crystallization. A concentrated solution of tannin is abundantly precipitated white, by muriatic, nitric, phosphoric, and arsenic acid, but is not affected by the oxalic, tartaric, acetic, lactic, citric, succinic, selenious or sulphureous acids. Nitric acid treated with tannin, decomposes it with rapidity, and converts it into oxalic acid. Tannin poured into a solution of gelatine in excess, produces a white precipitate, which is opaque, soluble especially if warm, in the supernatant liquor; but on the contrary, if the tannin is in excess, the precipitate resembles elastic membrane, in form, and is much less soluble.

Tannin forms with skin a compound absolutely insoluble; and it is possible by the following method to learn whether it is pure or mixed with gallic acid; leave the tannin to be tested, for some hours in contact with a piece of skin, whose hair has been removed by lime, agitating it from time to time, then filter the solution; if the tannin is pure, the liquid does not produce the slightest discoloration with the per-salts of iron, whereas if it contains gallic acid, in the slightest proportions, a deep blue color will appear. This experiment proves that the matter of the skin is not identical with gelatine. Tannin consists of

Carbon	0.5118	18	atoms or equivalents,
Hydrogen . .	0.0418	18	" "
Oxygen	0.4464	12	" "

A solution of tannin may be preserved indefinitely without alteration in a closed vessel; but with the contact of air, it absorbs oxygen giving off an equal volume of carbonic acid, and is converted into crystallized gallic acid.

Pure gallic acid is not affected by a solution of gelatine. It crystallizes in long, silky needles of a slightly acid, and styptic taste; and requires one hundred parts of cold water for its solution. It is more soluble still in alcohol, and a little less so in ether. It forms in the

solution of per-sulphate of iron, a deep bluish black precipitate, much less soluble than the tannate, and which being heated to ebullition in water, is decomposed with disengagement of carbonic acid. Dried at 120° C., it is composed of,

Carbon	0.4989	7 atoms or equivalents,
Hydrogen, . . .	0.0349	6 " "
Oxygen	0.4662	5 " "

When gallic acid is heated in a retort to the temperature of 200° to 215°C., it is changed entirely into carbonic acid gas, and into pyrogallic acid, which condenses in crystalline plates of a shining whiteness, and whose composition is expressed by the formula C^6 H^6 O^3. But if the temperature is suddenly raised to 240°, carbonic acid and water are disengaged, and there remains a black matter similar to charcoal, but which is a new acid, the *metagallic*, and whose composition is expressed by the formula C^6 H^4 O^2.

Tannin under the same circumstances yields similar results: only at the temperature of 215° C., there is always produced a certain quantity of metagallic acid along with the pyrogallic acid.

Pyrogallic acid possesses a whiteness like that of snow. It is exceedingly soluble in water, alcohol and ether. It enters into fusion at 115° C., and into ebullition at 210°. At 250° it blackens, disengages water, and is converted into metagallic acid; it instantly reduces the persulphate to the state of protosulphate, even in the cold without the disengagement of carbonic acid, and the liquid assumes a very fine red tint without being decomposed. It is composed of

Carbon	0.5761	6 atoms or equivalents,
Hydrogen . . .	0.0470	6 " "
Oxygen	0.3769	3 " "

The metagallic acid is of a brilliant black color, insipid, and insoluble in water. Potash, soda, ammonia and glucina dissolve it easily. It expels the carbonic acid from the alkaline carbonates, and forms black precipitates in the most of the metallic salts. It is composed of

Carbon	0.7310	12 atoms or equivalents,
Hydrogen . . .	0.0298	6 " "
Oxygen	0.2392	3 " "

In an isolated state, it contains in addition, 1 atom of water.—*Idem.*

3. *Formic Acid*, by Döbereiner. (Ann de Ch. t. 52, p. 105.)—The following is the best process for obtaining it. Dissolve 1 part

of sugar in 2 parts of water, mingle the solution in a copper alembic with $2\frac{1}{2}$ to 3 parts of well pulverized peroxide of manganese. Heat the mixture to about 50° C, and add gradually, (taking care continually to agitate the whole with a wooden spatula,) three parts of concentrated sulphuric acid, which has been previously diluted with its weight of water. On the addition of the first third of the acid, a lively effervescence takes place, which will cause the vessel to overflow, unless it have fifteen times the capacity of the mixture employed. Now put on the head of the alembic, and connect it with a refrigerating tube, in order to condense the acid vapors which are disengaged. As soon as the motion produced by this reaction is over, add the other two thirds of the acid, agitate the whole, and distil to dryness. A limpid liquid of a penetrating odor is obtained, which is composed of a mixture of water, of formic acid, and of an oily substance; neutralize this with chalk, and evaporate it in a retort, if it is desired to collect the ether which passes with the water in which it is dissolved, and from which it is to be separated by means of the chloride of calcium. One pound of sugar furnishes enough formic acid to saturate five or six ounces of chalk.

The formic acid is an excellent reagent for the reduction of the oxides and the chlorides of the noble metals; and it separates, when in acid solutions, the noble metals from all the others. This reduction and the separation take place instantly, or nearly so, in pouring into these solutions, heated almost to ebullition, a solution of an alkaline formiate. A brisk effervescence occurs in consequence of the transformation of the formic acid into carbonic, the metal is precipitated in a very fine powder, and so completely, that there does not remain a trace of it in the liquid. By collecting the carbonic acid gas, and measuring its volume, the quantity of the noble metal present, however small, may be ascertained very exactly. In the cold, formic acid does not disturb the proto-nitrate of mercury; but when heated to ebullition, the mercury is precipitated in the metallic state, while acetic acid forms with it a deposit of acetate in brilliant scales; this property is peculiar in distinguishing the acids apart. Nevertheless the best reagent for formic acid is the acetate of lead; the formate of lead is white and crystalline, slightly soluble in water, and insoluble in alcohol.

M. Gobel has made the following very interesting researches respecting this acid. The solutions of gold, platinum and palladium are not decomposed by it when free, even though heated to

ebullition. The acid is gradually volatilized without separating the least trace of the metal; nevertheless the formate of soda effects the entire precipitation of these metals, partly in brilliant scales, and partly in a pulverulent state. The solutions of nitrate of silver and of mercury are decomposed by free formic acid, but the decomposition is more prompt by the alkaline formates.

The red oxide of mercury offers a sure and easy method of determining the quantity of free formic acid, or when it is mixed with other acids, or combined with bases. The proportion of formic acid is determined by the volume of carbonic acid disengaged, when a liquid containing the formic acid is heated with the red oxide of mercury, the carbonic acid being collected and measured in a convenient apparatus. When the formic acid is combined with bases, it is necessary to add beside the red oxide of mercury, some acetic acid, in order to set the formic acid at liberty.

The formates of zinc, of copper, of cadmium, of bismuth, of lead, of nickel, of uranium, of cerium, and of cobalt, exposed to a red heat in a glass tube held in the flame of an alcoholic lamp, are decomposed, and their oxides completely reduced. The use of formic acid in obtaining the rare metals is so great, that it merits the preference over hydrogen; and since the production of this acid is now attended with so little expense, it is to be hoped that we may be able to effect the reduction of the noble metals on a larger scale than heretofore.

The formic acid may moreover, be employed in order to ascertain the quantity of oxygen contained in the peroxides. For this purpose, a determinate quantity of the peroxide is heated with the formic acid; the gas disengaged during the operation, and which is a mixture of carbonic acid and of the air of the vessels, is collected; the use of potassa enables us to determine the volume of carbonic acid present in the mixture, paying regard to the atmospheric pressure, its temperature and state of humidity; the volume of this acid is divided by 2; the quotient expresses the volume of oxygen derived from the peroxide.

The process of Doeberiner for obtaining the formic acid does not afford it perfectly free from acetic acid. Gobel recommends to get rid of this, by employing instead of chalk, carbonate of lead with the aid of heat; the acid liquor passes over by distillation and separating by crystallization, from the acetate which dissolves easily.

By distilling the formate with sulphuric acid, previously diluted with its weight of water, a pure and very concentrated formic acid is obtained, whose odor is acid and pungent.—*Idem.*

4. *Phosphovinic Acid*, by PELOUZE. (Ann de Ch. t. 52, p. 37.) Phosphoric acid in reacting upon alcohol, gives origin to this acid, which is formed of one atom of phosphoric acid and two atoms of alcohol. In order to prepare it, concentrated alcohol is mixed with phosphoric acid in a syrupy consistence, nearly in equal parts. The mixture is maintained for some minutes at a temperature of 60 or 80°C.; at the end of twenty four hours, it is diluted with seven or eight times its volume of water, and neutralized with pulverized carbonate of baryta. The liquid is raised to ebullition in order to expel the excess of alcohol. It is then left to cool to 70° C., filtered and suffered to remain for crystallization, when the phosphovinate of baryta crystallizes in beautiful, hexagonal tables, or scales. These are dissolved in water, and sulphuric acid is added to the solution, gradually, so long as a precipitate is occasioned; the liquid is filtered, concentrated at first to a certain point over a naked fire, and afterwards *in vacuo* with the aid of sulphuric acid, until it is reduced to a syrupy consistency. The acid has a gelatinous consistency; it is very acid, without odor, soluble in every proportion in water, alcohol and ether, capable of resisting perfectly a prolonged ebullition, when dissolved in several times its volume of water; decomposing, on the contrary, at this heat when in a concentrated state, and yielding at first a mixture of alcohol and ether, afterwards of carburetted hydrogen, and a residuum of phosphoric acid mingled with charcoal. It dissolves zinc and iron with the disengagement of hydrogen, and expels the carbonic acid of all the carbonates.

The phosphovinates are infinitely more fixed than the sulphovinates; they support a heat capable of inflaming wood; they change into neutral phosphates by calcination. The most of them are soluble in water. Those which do dissolve in this liquid, dissolve in the feeble acids. The salts of the protoxide of tin, of mercury, of silver, of lead, and of lime are the least soluble. The phosphovinate of baryta has a saline and bitter taste. It is much more soluble at 40° than at 0° and at 100° C. It is insoluble in alcohol and ether. It contains 0.306 of water, or 12 atoms. It loses this by calcination and becomes pearly white, but is not decomposed except in a dull

red heat, when it is transformed into a neutral phosphate, carbon, and carburetted hydrogen.

From the foregoing, it appears that the theory of etherification requires the following modification: sulphuric and phosphoric acid in contact with alcohol, form, in combining with it, a bi-sulphate, or a bi-phosphate of alcohol, which subjected to the action of heat, is decomposed into water, into sulphuric acid or phosphoric acid and into ether.—*Idem.*

5. *New Compounds of Platinum*, by Döebereiner. (Ann de Ch., t. 53, p. 204.)—If the chloride of platinum is mixed with a solution of carbonate of soda in excess, and exposed for some days to the sun, in a heat of 100°, a chrome-yellow precipitate will gradually appear, partly in powder, and partly in crystals, which is a compound of oxide of platinum and of soda, the proportions not being accurately determined, and which contains sometimes, besides, from 0.5 to 1.0 per cent. of chlorine. He regards it, provisionally, as a *platinate of soda.* Heated to redness, it gives at first a portion of water, afterwards some acid, and becomes at the same time black; in this state, water removes the soda it contains. The residue appears to be a mixture of platinum and oxide of platinum. Acetic acid removes from this salt, all the soda it contains, and leaves the oxide of platinum, of an ochreous yellow color. A small quantity of this oxide dissolves in the acid without coloring it; from whence it would seem to follow, that the oxide of platinum does not dissolve at all, or only with difficulty, in acetic acid. Formic acid decomposes completely the platinate of soda, when aided by a gentle heat. The reduced platinum has the appearance of a black powder, which becomes instantly red, when scattered over paper slightly moistened by alcohol. Oxalic acid dissolves the new salt, with the developement of carbonic acid, when heat is employed. Nitric acid also dissolves with ease, the platinate of soda, giving a deep yellow solution. By mixing the chloride of platinum with a little cream of lime, and afterwards adding a great quantity of water to the mixture, and exposing it after filtration to the sun, it promptly becomes cloudy, and after the expiration of some hours, a flocculent precipitate presents itself, which after being boiled, forms a yellowish white powder. This is a chloride of platinum, with platinate of lime, containing besides the oxide of platina, the lime, and the water, about 95 per ct. of chlorine.—*Idem.*

6. *Transformation of vegetable substances into a new principle,* by BRACCONOT. (Ann. de Ch., t. 52, p. 290.)—Vegetable substances produce when heated with concentrated nitric acid, compounds very different from those afforded when dilute nitric acid is used. Saw-dust, cotton, linen, fecula from the potatoe gum, issoline and saponine, heated with concentrated nitric acid, are transformed into a peculiar mucilaginous substance, called by BRACCONOT, *Xiloidine.* It is transparent, and is reddened by turnsole; cold water coagulates it, and boiling water softens, without dissolving, it. It is insoluble in alcohol and ammonia; and caustic potash dissolves it with great difficulty. On the other hand, the acids dissolve it in great quantity without altering it; the solutions leave upon bodies a brilliant varnish, perfectly insoluble in boiling water. It inflames by heat with great facility.—*Idem.*

7. *Creosote,* by LIEBIG. (Ann. de Chim., t. 53, p. 325.)—Dr. REICHENBACH has enriched the history of the dry distillation of organic substances with the discovery of this new body, which, on account of the great number of its properties, and of its being the basis of smoke, and pyroligneous acid, possesses the deepest interest for chemists, and will undoubtedly become extremely important in domestic economy. Its medicinal properties will likewise lead to its use in medicine.

Its preparation presents at present considerable difficulty, although it will undoubtedly be simplified, when its properties become better known. Thus far it has been obtained from oil, from pyroligneous acid, and from tar. The processes are slightly different, according to the substances employed. We give only that for pyroligneous acid.

Dissolve in impure pyroligneous acid at 70° or 80° C, as much sulphate of soda as it will take up: after a little while, separate the oil which makes its appearance upon the surface of the fluid, leave it to repose for some days, in order to separate a new portion of pyroligneous acid, and of sulphate of soda, and afterwards saturate it while hot, with carbonate of potassa, until the effervescence is over; a thick oil is separated, which is distilled with water; an oil of a pale yellow color is obtained, which is agitated repeatedly, with fresh portions of diluted phosphoric acid; the liquid is allowed to rest, and then washed with water until it manifests no farther acid reaction: finally it is distilled in a retort, with a fresh quantity of water

containing phosphoric acid, taking care to pour it back, from time to time. A colorless oil is obtained in the recipient, which is dissolved in a solution of caustic potash of the density of 1.12; the scum which rises is removed, and the liquid is left exposed to the air in a large vessel; the oil becomes brown from the oxidation of a foreign substance it contains; it is saturated with sulphuric acid, and the oil is removed while it is still hot and distilled. A bituminous residue remains in the retort. The solution in caustic alkali, and the following operations must be repeated until the oil no longer grows brown in the air, but merely assumes a slightly reddish tint. Distil the oil in a retort, with a more concentrated solution of potash, continuing the distillation so long as the liquid passes over clear, and finally rectify the product by distilling it anew in a small retort. The first portions that come over, being mixed with a good deal of water, are rejected, but the last are preserved as pure creosote. In all these distillations it is necessary to prevent the condensation of drops upon the sides of the retort, since they are liable to decomposition from the action of the fire; nor must the evaporation be carried too far.

It has the following properties: It is an oleaginous liquid, colorless, transparent, and powerfully refractive. Its odor is very penetrating and disagreeable; resembling that of smoked meat. Its taste is very caustic and burning, instantly corroding the tongue. It is a little oily to the touch, and has the consistency of oil of almonds. Sp. gr.=1.037. It boils at 203° C., and does not congeal even at −27°. It soils paper, but the spots are removed by holding the paper before a gentle fire. It burns in the lamp with a very red flame. It is a non-conductor of electricity.

At the temperature of 20° C., creosote forms two compounds with water; the first is a solution of $\frac{1}{4}$ of a part of creosote in 100 parts of water; the other is a solution of 10 parts of water in 100 of creosote. The tinctures of turnsole and of curcuma are not altered by the solution of creosote. It is not neutralized by acids nor by alkalies; and still it forms a great number of compounds with the acids and with the bases.

The concentrated creosote dissolves the oxide of copper and assumes a chocolate brown color; it reduces the oxide of mercury to the metallic state at the temperature of boiling water, and is converted into a resinous matter which contains no more creosote. With nitric acid, it forms very abundant red vapors. It readily dissolves iodine and phosphorus. Sulphur dissolves it slowly when cold,

but when hot, .37 parts enter into solution with it, and form a reddish brown liquid; in cooling, the largest part of the sulphur is deposited in crystals. Of all the organic acids, the acetic acid enjoys the strongest attraction for it. These two substances unite in every proportion. Other organic acids in the crystallized state, either dissolve in the creosote when cold or when it is hot; when they dissolve only in the first case, the acid separates on cooling. Creosote forms two different compounds with potassa; one, which is anhydrous, presents an oleaginous consistence; the other containing water, forms little white and nacreous crystalline plates. The creosote is separated from these combinations without alteration by the most feeble acids, even the carbonic. It behaves in the same manner, in relation to soda.

Creosote combines very well with lime and baryta, forming a white unctuous matter soluble in water. When dry, this matter forms a pale rose colored powder. Ammonia instantly dissolves the creosote in the cold. It dissolves very readily, a large number of alkaline, earthy and metallic salts, as well when cold, as when hot. Some of these salts undergo reduction by cooling, but the greatest number separate without alteration, the acetates of potassa, of soda, of ammonia, of lead, of zinc, the chlorides of calcium, of tin, &c. With the acetate of copper, a decomposition first takes place, but afterwards it dissolves separately, the acid and the base forming a brown liquid. It reduces the acetate of silver: the metal being thrown down in the state of a white powder, which under the burnisher receives a metallic lustre. When warm, the nitrate of silver is reduced with equal facility.

Alcohol, ether, sulphuret of carbon, naptha, and acetic ether combine with creosote in every proportion. The resins, and the resinous coloring matters are decomposed by it, some of them in the cold, and others when hot. Digested with indigo, it abstracts the color to itself, but it abandons it on the addition of alcohol or water. It coagulates albumen.

But the most important property of creosote, is that of retarding animal decomposition. Fresh meat, and even fish, soaked for a quarter or half an hour in a solution of creosote, is incapable of putrefaction, and may be dried completely in the heat of the sun. M. Reichenbach hence concludes that it is to the presence of creosote, that smoke owes its property of preserving from putrefaction; and he supposes with great reason, that this substance will become one of

great value in the preservation of meats for the use of ships at sea, in the army, and even in domestic economy, when a method shall be discovered of removing from meat, the disagreeable odor which the creosote communicates to it. He made a great number of experiments, in order to ascertain the manner in which the creosote acts in preserving meats; and he concludes, that it is in coagulating the albumen, and thus hindering it from putrefying, and that the fibrine, when thus isolated, does not appear liable to putrefaction.

Creosote acts as a poison upon the animal organization; put in a concentrated state upon the skin, it destroys the epidermis in a very little time. When diluted, it destroys small animals, such as fish. Plants die, when sprinkled with a solution of creosote.

Physicians have been acquainted for a long time, with the medicinal virtues of pyroligneous acid, the oil of Dippel, and more recently of a substance called *aqua empyreumatica*. It was suspected that these substances owed their virtues to the presence of creosote, and many experiments were made in relation to the subject. It was tried in many inveterate cases of caries, and the experiments were crowned with the most perfect success. It therefore promises to be of great utility in medicine.

It was impossible to obtain the substance perfectly anhydrous for analysis. It afforded in the hands of Mr. Ettling, by the process of combustion:

Carbon,	75.561	76.757
Hydrogen,	7.778	7.780
Oxygen,	16.661	15.463

The sample submitted to analysis would appear from the foregoing, to have contained 3 per ct. of water.—*Idem.*

8. *To determine the Nitrogen in Organic Compounds*, by Dumas. (Ann. de Ch., t. 53, p. 164.)—The following method is said to give the nitrogen with a precision, at least equal to that, by which we now obtain the quantities of carbon and hydrogen in the same bodies. A tube is arranged as common, taking care to place at its closed extremity, some grains of carbonate of lead; after having created the vacuum in the tube, a portion of the carbonate of lead is decomposed, in order to get rid of portions of air remaining in the tube, and to replace it by pure carbonic acid. After having disengaged rather more than a pint of carbonic acid, the vacuum is formed a second time, and the combustion is made as ordinary; the gases

are received over mercury, with a bell-glass, containing a strong solution of potassa. The decomposition being over, the carbonate of lead is heated anew, and about as much carbonic acid is liberated as before, in order to drive out all the nitrogen, and to force it into the bell-glass. After a suitable degree of agitation, the carbonic acid will be found to be wholly absorbed, and there will remain only the nitrogen, which may be measured with precision. The only precaution requisite to be taken, consists in decomposing a quantity capable of producing at least thirty or forty *cent. cubes* of nitrogen gas. —*Idem.*

9. *Oxide of Iron an Antidote for Arsenic Acid.* (*Annalen der Physik*, 1834, No. 6.)—The following is extracted from a letter of Dr. Brunsen to M. Poggendorf, dated Göttingen, May 1, 1834.—It is some time since I was led to notice the fact that a solution of arsenic acid is so completely precipitated by the hydrated oxide of iron, (perfectly pure, freshly precipitated and suspended in water,) that a current of sulphuretted hydrogen introduced into the filtered liquor, mingled with a little muriatic acid, reveals no trace of arsenic acid. I have ascertained more recently that this same substance, mingled with ammonia, and gently digested with arsenic acid, previously reduced to an impalpable powder, changes this last substance into an insoluble, basic arseniate of iron. A series of experiments founded upon this observation, convinces me, that this body unites the most favorable properties to serve as an antidote of the solid arsenic acid, as well as for its solution. Dr. Berthold, at my request, had the goodness to unite with me in the investigation with the view of submitting the subject, in its full extent to the most thorough examination. The results of the investigation have much exceeded our expectations, and we are confirmed in the opinion that the hydrated oxide of iron is a more efficacious antidote against arsenic acid, whether solid or in solution, than the white of an egg, is against the sublimate.

Young dogs, (not over a foot high) to which we administered from four to eight grains of arsenic acid, in the condition of a fine powder, (tying up the wind-pipe to prevent vomiting) lived more than a week, without giving the least symptom of poisoning by arsenic, neither during life, nor in dissection. The excrements, which were slight, because the animals lived without eating or drinking, contained almost all the whole of the poison in the state of the basic arseniate of iron, but no trace of undecomposed arsenic acid.

We are convinced from these experiments, that a dose of the hydrated oxide of iron, corresponding to two or four drachms of the oxide of iron, mingled with sixteen drops of ammonia, is sufficient to convert eight or ten grains of well pulverized arsenic acid, into this insoluble salt which we have mentioned. Besides, it is easy to perceive that in a case of poisoning from arsenic, these substances may be employed in much larger doses, with or without the ammonia, in drink, or by injections, since the hydrated oxide of iron, being a substance insoluble in water, exercises no action upon the animal organization.—*Bib. Univer. Aout.* 1834.

10. *Titanium one of the constituent principles of most primitive rocks.*—M. Peschier comes to this conclusion, from having detected the presence of this metal in four varieties of Feldspar, in the proportion of from 12. to 3.25 per cent, and in three kinds of Serpentine, from 8. to 5.25 per cent. He also finds 15.50 of Titanium in the Andalusite.

11. *Volatibility of Titanium*, by M. Zinken. (Ann. de Pog., t. 28.)—Having heated a large quantity of titanium obtained from the high furnaces of iron works, in a double crucible, in the heat of a furnace for melting steel, during several hours, the crucibles were found broken, but their interior was coated with metallic titanium, while the crystals had wholly disappeared.

12. *Preparation of Iodic Acid.* (J. de Pharm., t. 19, p. 222.)—It is easy to obtain Iodic acid on the large scale, by the following process: put one part of recently precipitated iodine into a matrass with a long neck, to which a long tube of about two lines diameter is fitted, make a mixture of eight parts of nitric acid with one and a half to two parts nitrous acid, and pour upon the iodine enough of the mixture to dissolve half or two thirds; afterwards apply a mild heat and gently agitate the vessel to throw down the iodine which has condensed upon its neck: after a few minutes add a new dose of acid, and proceed in this way until all the iodine has disappeared. Then pour the whole into a capsule of porcelain and the iodic acid is deposited. But it will be yellow, and in order to have it perfectly white, it must be dissolved in distilled water, filtered, evaporated, and when sufficiently concentrated, add to it, once or twice its volume of pure and fuming nitric acid, in order to precipitate the

iodic acid. Decant the mother-water, wash the acid once or twice with a little nitric acid, redissolve the residue in three times its weight of distilled water, and add to the solution two thirds its volume of pure nitric acid and evaporate to dryness in a porcelain capsule upon a sand bath, when very beautiful and perfectly crystallized iodic acid will be obtained.—*Idem.*

13. *To obtain the Manganesiate of Potassa*, by WÖHLER. (Jour. de Pharm., t. 19, p. 330.)—Melt in a platinum crucible over an alcoholic lamp some chlorate of potassa; dissolve in it a piece of alcoholic potassa, and add per oxide of manganese in powder. It dissolves with a very pure green color; it then forms the green manganesiate of potassa and the chloride of potassium. Dissolve the mass in boiling water; the green color changes to a brilliant purple because the manganesiate is converted into a per-manganesiate. Separate the precipitate by decantation and evaporate the solution: small opaque black crystals of the per manganesiate are obtained, which possess a greenish metallic lustre. This salt is isomorphous with the per-chlorate, and they crystallize together in every proportion, affording salts of very handsome and various colors.—*Idem.*

14. *Memoir on Tellurium*, by BERZELIUS. (Ann. de Pog., t. 28, p. 392.)—The mineral employed to obtain the subject of experiment, was the tellurium ore from Schemnitz, in Hungary. The ore pulverized and carefully purified by washing, with double its weight of carbonate of potash and a quantity of olive-oil sufficient to render the mixture pasty, was gradually heated in a covered crucible. The brown unmelted mass obtained was pulverized and treated with boiling water; and the liquor filtered, away from contact of the air. There remained upon the filter a black matter containing bismuth and carbon, but embracing only very little tellurium; and the fluid, which was of a deep reddish purple, took up all the tellurium combined with the potassium. By passing air through the liquor by means of the bellows, the potassium was oxidized and the tellurium precipitated. There remained only in solution a small quantity of sulphur and of seleniuret of tellurium, which could be separated by means of an acid. The tellurium on being well washed, was melted; after which in order to purify it, it was pulverized and placed in a little oval capsule, which was heated to a strong red

heat in a porcelain tube, traversed by a current of hydrogen gas. Tellurium, although so difficult to sublime when heated alone in a porcelain retort, is volatilized very readily in a current of this gas. There remains in the capsule a small quantity of telluret of gold, of copper, of iron and of manganese. There is volatilized along with the tellurium, a small quantity of selenium, which is wholly deposited at the extremity of the tube, under the form of a red powder. In order to separate all traces of this body, it is necessary to oxidate and calcine the substance; by which means all the selenium is volatilized in the state of selenious acid.

The telluret of silver cannot be treated in the same way. In order to extract the tellurium or to analyze it, it is necessary to heat it moderately in a current of chlorine, to receive the chloride of tellurium in water, acidulated by muriatic acid, to precipitate the tellurium by sulphite of soda, and afterwards to sublime it in hydrogen gas.

Tellurium contracts much in passing from the liquid to the solid state, on which account, it often contains cavities. When free from these its Sp. gr.=6.2445.

It has two degrees of oxidation, 1st. the oxide, or tellurious acid; 2ndly. telluric acid.

The tellurious acid presents itself under two modifications A and B. Variety A is produced when the tellurium is dissolved in nitric acid; it exists in the solution so long as it is rendered turbid by water, after which the liquid contains only variety B. The precipitate A is pure anhydrous tellurious acid: it melts into a transparent yellow fluid, which on cooling becomes a white, crystalline mass. It has a feebly metallic taste. It slightly reddens turnsole; it is nearly insoluble in the acids and in ammonia; nor does it dissolve in the alkaline carbonates, except by the aid of heat.

Variety B is obtained by melting tellurious acid with an alkaline carbonate, dissolving the fused mass in water and adding nitric acid until the liquid becomes slightly acid. The precipitate is an hydrate. It is in flocculi, white, and possessed of a metallic taste; it reddens turnsole, and is slightly soluble in water. It dissolves readily in the acids, in ammonia, and in the alkaline carbonates, from which it expels the carbonic acid. When heated to a temperature above twenty C. it changes to variety A. We are acquainted at present with no salts except such as are formed by variety B, of which there are those containing one, two and four atoms of acid for one of base.

In order to obtain telluric acid, a mixture of equal parts of tellurious acid and of carbonate of potash is melted together; the mass is dissolved in water and to it is added a quantity of hydrate of potash containing at least as much alkali as the fused mass, when a current of chlorine is passed through it until the chlorine is in excess, and until the precipitate which is at first formed, is completely redissolved; to the liquid is then added a small quantity of chloride of barium, which removes from it the sulphuric and the selenic acid it may contain: it is filtered and ammonia being added in slight excess, and afterwards chloride of barium, all the telluric acid is precipitated. The precipitate, at first bulky, shortly becomes granular and dense. It is washed, and dried by a gentle heat, and digested with one quarter of its weight of concentrated sulphuric acid, previously diluted with water, the liquid is concentrated, and finally left to spontaneous evaporation, when the acid is deposited in crystals having the form of flattened, four sided prisms, terminated by very low quadrilateral pyramids.

In this state, the telluric acid contains 0.225 of water, which it does not give up at 100° C. At a more elevated heat, but much below that of redness, it loses two thirds, or 0.155 without losing its form. Heated still more intensely, it becomes anhydrous and is converted into a citron yellow powder, which is a variety of the acid resembling variety A of the tellurious acid. Finally, when heated sufficiently, it gives up its oxygen and leaves behind a pulverulent, snow-white tellurious acid.

The telluric acid B is always soluble in water; when two thirds of its water is expelled, it is still soluble, but slowly. The anhydrous acid A is insoluble in all the acids. It dissolves in muriatic acid with the disengagement of chlorine, but with difficulty, and requiring the aid of heat. Telluric acid in solution is decomposed by sulphuretted hydrogen, not instantly, but slowly, and only with the aid of heat.

This acid possesses like the tellurious, a tendency to form salts which contain one, two and four atoms of acid, to one of base. By the action of heat, salts of the modification B are changed into salts of the variety A, afterwards they change into tellurites with the disengagement of oxygen, a red heat, however, is necessary to effect this transformation. When tellurious acid is heated with nitre at a temperature below redness, and so long as it disengages nitrous gas, and afterwards washed with water, there remains a citron yellow

powder, which is the tellurate of potash, containing modification A, and which is insoluble in the acids, and in the alkalies. In heating very powerfully in order to expel all the acid of the nitre and washing, there remains another salt of the modification A, but more basic, although insoluble. This salt, strongly calcined, is converted into a double tellurate, soluble in water.

Tellurious acid is composed of one atom of tellurium and two atoms of oxygen.

Telluric acid contains:

Tellurium, ...	0.7272—1 atom
Oxygen, ...	0.2728—3 atoms.

In its crystallized hydrate there are three atoms of water.—*Ann. des Mines*, t. v. p. 381.

15. *Hydrate of Phosphorus.* (Ann. de Pog., t. 27, p. 563.)—Phosphorus (says Rose) which has become white and opaque from having long been kept under water, is not an hydrate. After having been dried by sulphuric acid, it melts without any loss of weight or disengagement of water.—*Idem.*

16. *Phosphuret of Nitrogen,* by Rose. (Ann. de Pog., t. 28, p. 529.)—By delivering gradually, ammoniacal gas in a state of dryness upon the proto-chloride of phosphorus, contained in a tube surrounded by a freezing mixture, an ammoniacal chloride is formed. This compound is white; it dissolves slowly in water, and is converted into a mixture of phosphite and hydrochlorate of ammonia. By heating it away from the air in a glass tube, not liable to melt, and which is traversed by a current of carbonic acid, it is completely decomposed; hydrochlorate of ammonia, phosphorus, ammonia and hydrogen gas, are disengaged, and there remains a compound of phosphorus and nitrogen, perfectly white, when the chloride employed is perfectly dry, but brown and reddish when the chloride contains a little moisture. This compound is pulverulent, light, infusible, and fixed at a red heat. With the contact of moist air, it produces abundant vapors of phosphoric acid without burning. It is remarkable for its chemical indifference, being insoluble in water, in nearly all the acids and in the concentrated alkaline solutions. It is not attacked by sulphur, chlorine, or hydrochloric acid gas; the alkaline hydrates decompose it in the dry way, with the production of phosphoric acid and the disengagement of ammonia; at a red

heat, pure hydrogen gas decomposes it into phosphorus and ammonia, withont the production of water, nitrogen or hydrogen; sulphuretted hydrogen decomposes it at a red heat and a substance sublimes, which condenses in the state of a yellowish white powder, which contains sulphur and phosphorus, and which dissolves completely in caustic potash with the disengagement of ammonia.

In order to analyze the phosphuret of nitrogen, a determinate weight of it was mingled with an equal weight of the oxide of lead, to which was added nitric acid. The mixture was dried, calcined and weighed, which gave the phosphoric acid. Again, a certain quantity was mixed with the hydrate of baryta, and the mixture placed in a retort and covered with hydrate of baryta; the neck of the retort was afterwards drawn out to a point and introduced within a matrass, half filled with water, so that the opening was about one half of an inch below the surface of the liquid. To the matrass was adapted a second vessel containing concentrated hydrochloric acid. After the heat was applied, until the decomposition was completed, it was left to cool, when the hydrochloric acid passed over into the first matrass, and all the ammonia was condensed in the state of hydrochlorate. In order to learn the quantity of this alkali, it was combined with chloride of platina and calcined, the platina weighed, &c. It resulted from these experiments that the phosphuret of nitrogen has the following composition:

Phosphorus, . . .	0.5256 . . .	1 atom
Nitrogen, ...	0.4744 . . .	2 atoms.

17. *A new compound of Iodine and Oxygen, the Hyper Iodic Acid*, by M. M. Ammermuller and Magnus. (Ann. de Ch., t. 53, p. 92.)—It is impossible to obtain the hyper-iodic acid by the method which Serullas followed in procuring the hyper-chloric acid: for in heating the iodate it does not give rise to the hyper-iodate. In preparing the iodate of soda by the process of Liebig, which consists in saturating alternately with chlorine and carbonate of soda, iodine diffused through water, there is often formed on evaporation, a white deposit, heavy and crystalline, which is the basic hyper-iodate of soda. The best way of preparing this salt is to pass chlorine through a solution of iodate of soda, to which caustic soda is added. The hyper-iodic acid is obtained by decomposing with water, the hyper-iodate of silver. This acid is soluble in water and the solution may be heated to ebullition without causing its decom-

position. It crystallizes by evaporation; its crystals are not deliquescent; at an elevated temperature, it is entirely decomposed and passes to the state of iodic acid. Hydrochloric acid transforms it into iodic acid with the liberation of chlorine. According to the composition of the salts which it forms with silver, it is found to contain seven atoms of oxygen and two atoms of iodine.

The neutral hyper-iodate of potash in little white crystals, slightly soluble and similar to the hydrochlorate of potash, is converted into iodide by calcination; it contains:

Iodide of potassium,	0.72108
Oxygen,	0.27892

The sub-iodate has the same solubility as the neutral salt; it contains:

Potassa,	0.17059
Iodide of potassium,	0.59807
Oxygen,	0.23134

The neutral hyper-iodate of soda, is easily soluble in water, and uncrystallizable. It is converted into iodide by calcination, and contains:

Iodide of sodium,	0.80018
Oxygen,	0.19982

The basic hyper-iodate is almost insoluble in cold water, but it is slightly soluble in warm water, and very soluble in dilute nitric acid: this salt possesses the remarkable property of giving up only three fourths of its oxygen at a white heat; it contains:

Soda,	0.11505
Iodide of sodium,	0.55016
Oxygen,	0.23547
Water,	0.09932

There are three hyper-iodates of silver, one yellow, another red, and the third orange. These three salts are insoluble in water, but soluble in nitric acid; in evaporating this solution at a low temperature, the yellow crystals are separated, whereas, when the evaporation is conducted at a high temperature, it yields the crystals of the neutral salt.

The yellow salt is composed of:

Silver,	0.48981
Iodine,	0.28598
Oxygen,	0.16307
Water,	0.06114

It is instantly converted into the red salt by the action of hot water.

The red salt is composed of:

Silver,	0.51062
Iodine,	0.29813
Oxygen,	0.17000
Water,	0.02125

Nitric acid employed in due proportion and aided by heat, converts these two salts into the neutral orange salt, which is composed of:

Silver,	0.42313
Iodine,	0.36237
Oxygen,	0.21448

It is therefore a neutral anhydrous salt. Water decomposes it into an insoluble, basic salt and into pure hyper-iodic acid, which remains in the liquid and does not contain a trace of silver. The residue is yellow, when cold water is used, and red when the solution is heated.—*Idem.*

18. *Boracic Acid of Tuscany.*—It occurs chiefly in the lakes of Montecerboli and of Castel-Nuovo upon the royal road from Volterra to Massa, situated in an arid soil covered with fragments of a stratified shelly limestone, mingled with pyrites and slates. It also comes to the surface in gaseous currents, which have a temperature of 120° or 140° C. The annual produce is 700,000 pounds, which yields a profit of 300 francs to the 1000. The manufacture is due to the chemist Hoefer, who made the discovery in 1777.—*Idem.*

19. *Manufacture of Carbonate of Soda*, by Prukkner. (Ann. de Schweigger.)—Commence by changing the calcined sulphate of soda into sulphuret of sodium, by heating it to redness with pulverized charcoal. Dissolve the sulphuret and add to the warm liquor, oxide of copper. Filter and evaporate the liquid until its Sp. gr. = 1.41 or 1.48. On leaving the solution for twenty four or forty eight hours, the undecomposed sulphate of soda crystallizes. Evaporate the supernatant fluid to dryness. This process gives for one hundred of sulphate of soda about sixty five of crude caustic soda. To convert this into carbonate, it is heated gradually to redness with charcoal. Metallic copper as well as its oxides may sepa-

rate the sulphur from the sulphuret of sodium; but on the large scale, the protoxide is preferable. In order to procure this oxide, heat metallic copper to redness and plunge it into water containing in solution 0.02 of the nitrate of soda of Chili. The sulphuret of copper derived from this manufacture, mingled with one sixth of powdered sulphur, is easily transformed into a sulphate by roasting.—*Idem.*

20. *Preparation of Artificial Ultramarine*, by ROBIQUET. (Acad. des Sc., 1er. Sept. 1832.)—Introduce into a stone-ware retort, luted with clay, a mixture of 1 part of kaolin, 1½ parts of sulphur and 1½ parts of dry and pure carbonate of soda; then heat gradually so long as any vapors are disengaged; leave the retort to cool; break it, and there will be found in the interior a spongy mass of a very fine green color, but on attracting moisture from the air, it passes gradually to blue. Wash the mass; the excess of sulphate dissolves, and there remains a very beautiful blue. Wash it by decantation, dry and calcine it anew in a cherry-red heat in order to expel the excess of sulphur. The blue thus prepared, is of a very agreeable color, although it lacks the intensity and does not give the azure blue reflection of GUIMET; but this difference may render it desirable to painters in particular cases.—*Idem.*

21. *Annual yield of Cementation-Copper of the Rio Tinto Mine in Spain.*—The first working of this mine dates back to the times of the Romans; the Arabians and the Moors explored them in their turn, and demolished all the works when they were driven from the province of Seville. The exploration was resumed at the commencement of the 18th century, but it was not before the year 1787 that it had acquired that importance which it has maintained to the present day, in consequence of the attempt to extract by cementation the copper contained in the vitriolic waters issuing from the ancient works. It would seem that the iron employed in this process is furnished, at the present day, exclusively by the forges of Pédroso, which supply, annually, 2,400 quintals for this object. With this quantity, it is said, they prepare 1,800 quintals of copper. These mines have received a fresh impulse since the province of Seville has ceased to receive copper from Chili and Peru. Rio Tinto supplies entirely, at present, the foundery of Seville.—*Itineraire d' un Voyage en Espagne.* Ann. des Mines, t. v. p. 216.

22. *On the Roasting of Copper Ores*, (Ann. du comptoir des mines de fer, in Sweden.)—Hitherto the Fahlun copper ores have been roasted in rectangular spaces, but some recent experiments have satisfactorily shown that reverberatory furnaces are the best. The ore must be reduced to the state of a coarse powder, in which condition it requires only eighty eight hours for completing the process. —*Idem.*

23. *Reduction of the Chloride of Silver.* (Journ. of ERDMANN, 1833, p. 270.)—The best way of reducing the chloride of silver, is that of MOHR, which consists in mixing the chloride with one third its weight of colophony, and heating the mixture gradually in a crucible until the flame loses its blue color; after which, a strong heat is applied to melt the reduced silver.—*Idem.*

24. *Preparation of the Purple of Cassius for staining glass and enamels.* (Journ. of ERDMANN, 1833, p. 22.)—The nature of the precipitate obtained by mingling a solution of gold and one of tin varies in color and composition, with a multitude of circumstances; in general, it is a mixture of a compound of oxide of gold, and of oxide of tin, with metallic gold, and oxide of tin. A composition of constant properties, and suited to stain glass and enamels may be obtained as follows:

Dissolve one part metallic gold in four times its weight of nitro-muriatic acid; evaporate the solution until a crystalline pellicle appears at the surface, decant the red liquor, leave it to solidify by cooling, heat the mass with six times its weight of distilled water, and filter it, in order to separate a little gold, still in the fluid. Dry the crystallized protochloride of tin of commerce, by compressing it in bibulous paper, and dissolve one part in four times its weight of distilled water, filter the solution rapidly, in order that the basic salt may not separate. Finally dissolve one part of gum-arabic in two of warm water, and filter the solution through coarse paper. Mix twenty eight grammes of this solution with three ounces of distilled water, add to it twenty four grammes of the solution of tin, and afterwards twenty three grammes of solution of gold. The liquid becomes of a reddish brown, and afterwards of a clearer red. As the effect of an excess of acid is always injurious, it is well to add to the solution of gold, ten grammes of carbonate of potassa, but this is not indispensable. The red liquor does not give a precipitate

spontaneously, because the purple compound is held in solution by the gum. In order to throw it down, alcohol is added of the sp. gr. of 0.75, and in the proportion of twice its weight, if carbonate of soda has been employed, and three times, if the solution of gold has been left acid. The purple is deposited gradually, bringing with it a certain quantity of gum; of which it contains the more, in proportion as more alcohol is employed. In order to give density to the purple, it is washed with alcohol, thrown upon a filter and pressed in bibulous paper. In order to purify it, and to separate the muriatic acid it may contain, rub it in a mortar with alcohol of 0.50 so as to make a clear jelly, after which add largely of alcohol, bringing the liquid to ebullition for two or three minutes, and then add abundance of water, and leave the purple to deposit itself, finally washing it with a small quantity of water, in the way of decantation. It then contains only a small quantity of gum, which facilitates its ultimate use. It is necessary, however to execute the paintings with the oil of turpentine, since if water is used, the gum swells up, and the action of the fire will produce scales over the surface of the painting.—*Idem.*

25. *New method of producing heat.** (Mem. Encyclo., t. 3. p. 336.)—By projecting upon a fire, a mixture of water and oily matters in a certain proportion, a flame is produced, whose heat is extremely intense. If the water be in excess, the flame languishes; or if in too small quantity, a smoke is produced. For 1 measure of tar, it is requisite to employ about 1½ of water. 15 lbs. of oil of turpentine mixed with 15 lbs. of water, and projected upon 25 lbs. of Newcastle coal, produced as much heat as 120 lbs. of this coal.—*Ann. des Mines*, t. 5. p. 378.

26. *The best method of assaying the ores of Manganese*, by Zenneck. (Journ. d'Erdmann, t. 18, p. 75.)—The principal pneumatic methods are the following: 1. Calcination and measuring the quantities of oxygen gas evolved; 2. Ebullition with concentrated sulphuric acid and measuring the quantities of oxygen; 3. Calcination with sugar, and measuring the volume of carbonic acid formed; 4. Ebullition with muriatic acid, and measuring the quantity of chlorine disengaged; 5. Ebullition with muriatic acid and making

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* Mr. Samuel Morey, long ago detailed similar facts in this Journal.—*Ed.*

the chlorine gas to react upon liquid ammonia, and measuring the volume of nitrogen which results from the reaction; 6. Calcination with sal-ammoniac and measuring the gas evolved; 7. Ebullition with oxalic acid and estimating the carbonic acid produced. The 5th method is pronounced the best. The 4th is also good, but the 6th and 7th are erroneous.—*Idem.*

27. *New method of preparing Zaffre in Sweden.* (Dict. Techno. t. 19, p. 14.)—The oar is roasted until the greater part of its arsenic is expelled, after which a sufficient quantity of concentrated sulphuric acid is mixed with it to form a thick paste, which is exposed to a moderate heat, at first, and afterwards pushed to a cherry red, for one hour. The sulphate thus obtained, is reduced to a powder and dissolved in water; and to it a solution of carbonate of potash is gradually added, in order to separate the iron, and when it is perceived by the blue color that the cobalt is thrown down, the supernatant liquid is decanted and filtered, and the cobalt is precipitated by means of a solution of a silicated potash, which is prepared by heating in an earthen crucible a mixture of 10 per cent of potassa, 15 of well pulverized quartz, and one of charcoal, and treating the melted mass with boiling water. The silicate of cobalt thus prepared, is superior to that obtained in any other way for staining porcelain, or for the manufacture of blue glass.—*Idem.*

28. *Gas Lights.*—We abstract the following from the reports of M. Pouillet upon the results obtained by M M. Boscavy and Danre in the manufacture of illuminating gas from rosin. The first object was to determine by numerous experiments the illuminating power of gas from rosin, whether burnt through orifices of a circular shape (like the carcel or argand lamp) or from flat openings which give a fan-shaped flame of different dimensions. In all the experiments the flame of a carcel lamp was taken for unity. This lamp and the orifice submitted to experiment, was made to shine upon a sheet of white paper, drawn upon a frame, while a cylindrical stem between it and the lights, projected upon the paper their shadows. The orifice being fixed, the lamp was removed or brought nearer, until the shadows perfectly corresponded. In the round orifice the illuminating power of the gas from rosin was more than double that from oil-gas; in the flat orifices, it was only one and three quarters greater.

Another object was to prove the effect of temperature on the gas. Accordingly it was passed through a serpentine tube twenty five feet in length, which was maintained at a temperature 8 or 10°C. below zero. The light was not in the smallest degree diminished, nor were its deposits upon the orifice at all increased. It was ascertained also that the deposits were equal, in burning oil gas and that from rosin.

In order to compare the expense of the two gases, it was found that five cubic feet of gas from rosin gave as much light as nine of oil gas.

Respecting the products of combustion, or the purity of the gases, the advantages in favor of gas from rosin are incontestable.—*Bul. de la Soc. d'Encour. pour l'Indus. Nat. Pour Fev. et Avril,* 1834.

29. *A new green pigment for Artists.*—This color was discovered by M. PANNETIER, a painter of eminence who had studied chemistry with the view of preparing colors suitable for staining porcelain. It is prepared with chrome, and possesses a very brilliant, bluish green color. When employed in a state of purity, it does not represent the beantiful green tints of plants; but nothing is easier than to modify its shade by the addition of brilliant yellows, or of Scheele's green which is obtained very yellow. The new color has a good deal of body; it spreads easily under the brush; it possesses a more intense tone than the copper greens and has not like them the inconvenience of running, however little they may be diluted with a viscid oil. It has been submited for six years to the action of solar light, without having suffered the slightest alteration. It has been variously blended with other colors, and a similar trial, though only for one year, has been made, but which has been attended with the same success.

Notwithstanding the great number of colors, which painters have at their disposal, there is still not enough to fill all the intervals of the chromatic scale. With the finest blue and the most beautiful green hitherto within their reach, it would in the opinion of M. MERIMEE (to whose consideration the subject was referred) still be impossible, to imitate the brilliant bluish green tint of the new pigment.—*Idem. Mars,* 1834.

30 *Improvement in the manufacture of sealing wax.*—M. VICTOR ROUMESTANT, sealing wax maker to the king, is said to have greatly improved the quality of this article by new processes, besides having

reduced its cost one half. In order to render these improvements intelligible it will be necessary to give the process followed by those who have hitherto made the best sealing wax. The components of sealing wax are gum-lac, resin and a coloring matter. The lac is rendered fluid by means of turpentine, since the greatest part of it would be lost by attempting its fusion: the turpentine is put into a basin over a gentle fire, when it is gradually made to liquify four times its weight of the lac. When it is entirely melted, vermillion, or some other color in the state of a powder, is added. A little volatile oil, as that of rosemary, or lavender is also added: when the mixture, is poured upon a marble table. When cool, it is broken into little fragments and melted in a skillet, after which it is poured into moulds. When cold it is polished. The polishing is effected by the following arrangements: a furnace is so constructed as to have two fires, and between the grates which hold the coals, is an interval of from eight to ten *centimètres*. It is in this space between two glowing fires, that the stick of wax is held at one end by means of pincers. It is immediately melted at its surface, and softened throughout. In this state it is compressed in a mould of polished steel, where it receives the stamp of the manufacturer's name. Before it becomes cold, the ends of the sticks projecting from the mould are cut, which operation gives them all the same length.

M. Roumestant, has regulated his manufacture agreeably to his observation, that the quality of the wax depended not only upon the materials employed, but upon the proportions in which they were used. Some of these materials, such as the volatile oils, contribute to render the wax more inflammable, and to keep it fluid when dropped on paper to form the seal. If the wax remains too long over the fire, a part of the volatile matters evaporate. The wax is melted but once; all the materials exactly weighed, and in the proportions found to be best, are put into earthen pots, which are placed upon openings in a furnace to which they exactly fit. In order to accelerate the fusion, a stirrer is employed, formed of half a disc, having a little square channel, to which is fitted a wimble handle. As soon as the fusion is complete, the vessels are removed from the fire, and the wax is run off into marble moulds. It is soon cooled; the moulds are opened, the sticks are taken out and rubbed by a workman with a sand paper, in order to remove from them any little inequalities of surface they may possess. Their form is elliptic instead of cylindrical, which contributes to the rapidity of polishing.

One hundred of these sticks are placed side by side, upon the marble table, but without touching. When two men take an iron frame upon which a plate of iron heated to redness is placed, which they pass backwards and forwards at a little distance above the wax, and in less than a minute, the whole number of sticks receives a polish on one side. They are then polished in the same way on the other side. The method of marking is so simple that it can be done by children. The part of the stick to be marked is held over the high chimney of an Argand lamp, and when softened, is placed upon a support, where the impression is given by a little lever press.

The qualities demanded in sealing wax are, to remain inflamed without dropping for some time, so as not to oblige us to hold the letter too near to the candle. It is necessary also, after having inflamed the stick, that we have time to bring it over the letter, without the drops falling, that the wax remain fluid upon the paper long enough to enable us to spread it with the stamp, and to remove the coating of black smoke, which at first covers the fluid mass.* All these qualities are united in this sealing wax, besides which it sells for five francs the pound, while that of others costs eight to ten francs.—*Idem. Avril*, 1834.

31. *Filtration,* (Journ. de Pharm. t. 19. p. 281.)—When a powder saturated with a fluid, but not in the condition of a paste, is placed in the lower part of an open vase, and another liquid poured upon it, the last liquid permeates the powder and completely replaces the first, without mixing with it. This substitution is independent of the specific gravities of the fluids; thus water drives out alcohol and wine, and alcohol and wine drive out water.—*Ann. des Mines*, t. 5, p. 376.

32. *Purification of Water.*—In order to precipitate the earths mechanically suspended in water, it is recommended to employ the silicate of potash, gelatinous silica or phosphoric acid. The last is an excellent reagent for throwing down the oxide of iron, without introducing any foreign principle into the water.—*Idem.*

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* It has been remarked, that the older the wax grows, the less prone is it to produce this black pellicle, a circumstance no doubt, depending upon the evaporation of the turpentine from exposure to the air.

Art. XIII.—*Conduction of Water*; by Prof. Chester Dewey.

It is admitted, in opposition to the dogma of Count Rumford, that water slowly conducts *caloric* from particle to particle. To prove this fact it was thought necessary to show that caloric would pass downwards, if it was applied at the surface. The experiments have been of three kinds; a thermometer is immersed in water, on whose surface hot oils are carefully poured, or ether or alcohol is burned, or a hot bar of iron held over it. In all these cases, the thermometer indicates a rise of temperature, and it is inferred that the caloric has been conducted downwards. Now, is not more attributed to these experiments, than they are *known* to prove. Is it certain that the caloric does not *pass downwards* by *radiation*, when a hot iron is held over the water or when hot oils are on its surface, for in cooling these would radiate caloric upwards, and where is the proof that a portion may not be radiated downwards? and thus also, when a liquid is burned on the surface. Again, is it ascertained for a *certainty*, that the chief part of the result is not dependent upon the conduction of the caloric downwards and along the sides of the vessel? That in glass vessels, something may depend on this, no one will be disposed to deny. If we are pointed to Dr. Murray's experiments in vessels of ice, the reply is that they touch not the case of other vessels and *prove not the point* in their own. For, the water will have the temperature of the ice, viz. 32°, Fah., and will be *lighter* than water at any temperature below 40°. Of course, when hot oils are put on the surface, the water in contact with the oil will have its temperature raised, and therefore *be heavier*, and sink to the thermometer, and thus raise its temperature *without affording the slightest proof of the conduction of the caloric from particle to particle.* The experiments of Dr. Murray are a complete failure, unless the temperature of the water is preserved above that of 40°. And what is further to be noticed also, the less the water *does conduct* or the *more perfectly it retains* the caloric received from the oil, the more quick and striking will be the rise of the thermometer, and the more complete the deception in the experiments. In this way, therefore, it cannot be proved that much of the result in common vessels is not dependent upon the passage of caloric along the sides of the vessel. Although all these experiments are so defective, there is yet full proof by a familiar experiment of the conduct-

ing power of water, viz. that if water at 150° be mixed with an equal quantity at 50°, the temperature of the mixture will instantly be 100°. Now this can be done only by the passage of the caloric from particle to particle; for, otherwise, the colder would sink to the bottom, and the change of temperature be effected very slowly. This is only one of the many cases in which philosophers have overlooked simple and familiar, and complete proof of the law to be ascertained.

Although it is thus evident from the established facts of the expansion of water both above and below 40°, that the experiment of Dr. Murray affords no proof of the conduction of caloric from particle to particle, I thought it advisable to repeat the experiments, and notice the facts. Having procured a solid mass of ice, I hollowed out a place for the thermometer, to the depth of more than an inch, and covered the thermometer with water at a temperature below 40°. It had been previously ascertained that the mercury stood at 32° in melting snow.

The water in the different experiments was on the bulb of the thermometer, from one eighth to three eighths of an inch deep, and of course deeper over all the other parts of the thermometer. Care was taken too, that the bulb should not be in contact with the ice. The water on the thermometer soon fell to about 33°. Oil, heated to 160°, 173°, 184°, 260°, and 285°, was in successive experiments poured carefully on the water, and floated over the whole surface. The thermometer rose to 35°, and 36°, and even to 38°, as the oil was of higher temperature, and in greater quantity. Though the temperature rose to 38°, in several of the experiments, it never exceeded that point. The ice was melted by the *oil*, so that the water was from one fourth to three fourths of an inch deep on the bulb. In two or three minutes the thermometer began to descend, although the temperature of the oil along the middle of it, and over the bulb was higher than that of the thermometer. These experiments show no proof of the conduction of caloric. The reason why the mercury rose only to 36° or 38°, and so soon began to descend, is doubtless to be found in the melting of the ice, and the temperature and weight of the water just formed from the ice, and in the fact that the water, heated to 36° or 38°, would on sinking to the bottom lose its temperature in melting the ice, and both it and the new melted water at 32°, would then ascend towards the surface. So soon as the temperature of the oil was reduced to a certain extent, this melting and

change of particles would permit further rise of the thermometer, and soon cause it to fall.

In the next place, *ether* poured on the thermometer, situated as before, was set on fire. The thermometer rose to 36°, and once to 38°, when a greater quantity was burned. The ice was melted more rapidly than in the preceding experiments, because the flame acted on a greater surface of ice. Soon after the combustion ceased, the thermometer began to descend.

In the next place, the hollow in the ice was so enlarged, as to permit a pound weight of *red hot iron* to be held over the bulb of the thermometer placed one fourth of an inch under the surface. The thermometer soon rose above 36°, while the ice was rapidly melted; the continuance of the iron did not increase the temperature of the bulb, and as soon as the iron was removed, the thermometer began to fall.

All these experiments lead to the same conclusion as the first.

In the last place, the thermometer was immersed in water in an earthen dish, at the temperature of 58°, and half an inch deep over the bulb, and the bulb was placed two inches from the outer edge of the water. Oil at the temperature of 280° was then poured carefully on the surface, and at the other end of the thermometer. The thermometer rose slowly, as the oil floated over the bulb, more than 12°, or a little above 70°.

From the first three sets of experiments it results, if water expands below 40°, that the rise of the thermometer was owing to the *descent of the heated but heavier particles of water*, unless a part of the effect is to be attributed to the *radiation* of the caloric through the water to the bulb, and its absorption by the bulb.

Experiments similar to the last, have often shown that water does *conduct caloric downwards from particle to particle*, except such part of the effect as may be supposed to result from radiation as before stated. For it can scarcely be believed that in such experiments, the caloric passes by and along the vessel to the thermometer. The *mixture of cold and hot* water, and the almost instantaneous reduction of temperature from 40° or 60° to 150° or 180°, according to the relative quantity and temperature of the water employed, is *proof incontrovertible of the conduction of caloric from particle to particle in any direction.* This *fact* is a most benevolent provision in the constitution of water, and it is so well known to the learned and ignorant, that it is amazing Count Rumford should have

overlooked it, and have attempted to prove a principle directly opposed to it.

That caloric radiates through water, at least as it comes in the solar beam, is proved by the higher temperature of the shallow water along the borders of ponds in the clear and still days of summer. The *warmth of the sandy bottom* shows the absorption of the caloric as it has passed through the water in its course of radiation.

ART. XIV.—*Synopsis of a Meteorological Journal, kept in the city of New York during the years* 1833 *and* 1834; by W. C. REDFIELD; reported to the Regents of the University of the State of New York, January 22nd, 1835.

THE annual report of the Meteorological observations which are made at the several Academies in the State of New York, under the direction of the Regents of the University, is justly valued as comprising the most extensive system of cotemporaneous observations that has yet been placed within the reach of scientific enquirers. A desire to add in some degree, to the mass of information contained in this document, has induced the communication to the honorable Regents of the observations and remarks which follow.

The meteorological journal from which the observations are compiled has been kept in the city of New York, from which place, returns do not appear to have been usually made to the Regents. Besides the usual notices of temperature and winds, care has been taken to observe with particularity and precision, the direction of the more elevated currents of the atmosphere, as indicated by the movements of the clouds, with a view to ascertain the connexion, if any, which exists between the movement of the surface-winds, and the higher currents. It was also desired to afford to some extent, by these observations, the means of ascertaining the consecutive character, in a geographical view, of those atmospheric changes which are so constantly experienced, and of which, apparently, so little is understood. These observations have accordingly been made at frequent periods, commencing with the hour of 6 A. M., and ending with 10 P. M. With the same objects in view, the state of the barometer, so interesting in its connexion with the vicissitudes of weather, has been duly noted at the same periods.

The following table exhibits the result of the observations of the surface-winds, and also of the more elevated current or main wind, as indicated by the highest observed movement of the clouds.

Observations for the year 1833.	SURFACE WINDS.				HIGHEST OBSERVED CURRENT.			
	From N. E. quarter, including N.	From E. to S. including E.	From S. to W. including S.	From W. to N. including W.	From N. E. quarter, including N.	From E. quarter.	From S. W. quarter.	From N. W. quarter
January, . .	32	9	59	35	5	6	46½	30½
February, . .	22½	5½	48½	57½	1	1	45½	48½
March, . .	29½	21	49½	47	4	4	53	25
April, . .	22	26½	63½	23	4	3	65½	28½
May, . .	41½	55½	32	13	3	3	77½	28½
June, . .	15	33	45	47	0	1	40	68
July, . .	15	16½	74	40½	5	2	65	54
August, . .	28½	30½	59	31	1½	3½	83½	35½
September, . .	25½	13½	64½	29½	9	3	89½	20½
October, . .	15½	23	54	44	12	5	77	33
November, . .	23	11	74	36	5	4	62	26
December, . .	79½	1	23	43½	28	1	53½	25½
	349½	246	646	447	77½	36½	758½	423½

From the above table it will be seen, that the total of Easterly winds observed during the year, reckoned in periods of four hours each is 595½

Total of Westerly winds, ... 1093

The prevailing winds are the Southwesterly. But the predominance of Westerly wind at the surface is far less striking than that which is exhibited by the upper wind, or main atmospheric current, the observations of which, it will be seen are as follows,

Easterly, ... 114

Westerly, ... 1182

The prevailing upper current or natural wind is also Southwesterly.

Proportion of Westerly surface wind in 1000, 647

" " " upper wind in 1000, 912

Observations for the year 1834.	SURFACE WIND. N. E. quarter.	S. E. quarter.	S. W. quarter.	N. W. quarter.	HIGHEST OBSERVED CURRENT. From N. E. quarter.	S. E. quarter.	S. W. quarter.	N. W. quarter.
January, . .	38	1½	52½	57	4	2½	59	30½
February, . .	43	16	35½	29	7	0	56	20½
March, . . .	19	15	70	39	3	4	78	22
April, . . .	47	17½	44½	26	5	5	54½	24½
May, . . .	25	25	61½	35½	9	1	55	31
June, . . .	22½	27	62½	30	11	13	34½	42½
July, . . .	32	13½	88	9	2	0	100½	25½
August, . .	46	11½	58½	24	9	0	61	39½
September, . .	29½	13	61	34½	6	1	72½	21
October, . .	9	6	69	67	3	0	70½	40
November, . .	28	2½	53	60½	0	0	69½	46
December, . .	43	1	48½	35½	4	0	51	37
	382	149½	704½	447	63	26½	762	380

The observations of Easterly winds as shewn by the last table, are 531½

" " of Westerly do. 1151½

Prevailing winds, Southwesterly.

Observations of Easterly upper wind, . . . 89½

" " Westerly " " . . . 1142

Prevailing upper winds, Southwesterly.

Proportion of Westerly surface wind in 1000, . . 684

" " Westerly upper " " . . 928

My journal for the year 1832 is imperfect in consequence of interruptions, amounting in the aggregate to about three months, and is therefore omitted. The proportion of Westerly winds which it records is 672 in 1000.

These results, in their general character, appear to coincide with the observations which have been made in other parts of the United States, and it is believed are by no means peculiar to the place in which they were observed. Indeed there is evidence which is deemed sufficient to establish the position, that we have a southwesterly and westerly current of atmosphere, of varying altitude, sweeping over the United States, as regular and as constant as the northeasterly and easterly winds which prevail at the Island of Barbadoes, or in the general region of the trade winds.

The results of the thermometrical observations are omitted, as being of less general interest in an abstract of this kind.

In dividing the horizon into four equal parts, in the foregoing tables, the first or cardinal point in each quarter of the compass is included; N. being included in the N. E. quarter, E. in the S. E. quarter, &c.

It is deserving of particular notice, that during some of the coldest periods of winter in this occasionally severe climate, the predominating winds blow from the southwestern, or southern quarter of the horizon. This fact appears to be established by the annual reports which have been made to the Regents of the University, and, it is believed, will become obvious in proportion to the accuracy of our observations. It sufficiently demonstrates (without resorting to other evidence) the fallacy of the notion commonly entertained, that winds are generally rectilinear in their progress and blow for the most part in right lines, over extensive portions of the earth's surface;—an error which appears to remain undisturbed in the minds of most meteorologists.

OF THE BAROMETER.

The results in the following barometrical table, has been obtained from a well adjusted Barometer, the position of which is supposed to be about ten feet above the mean level of New York harbor.

Table of the mean height of the Barometer in inches, at five daily observations.

1833.	6 A. M.	10 A. M.	2 P. M.	6 P. M.	10 P. M	Monthly mean.
January, . .	29.975	29.982	29.963	29.975	29.978	29.975
February, . .	30.041	30.058	30.001	30.012	30.042	30.031
March, . .	30.080	30.104	30.030	30.035	30.062	30.063
April, . .	30.031	30.060	30.023	30.000	30.015	30.025
May, . .	30.063	30.117	30.092	30.074	30.089	30.087
June, . .	29.943	29.963	29.934	29.922	29.940	29.940
July, . .	30.011	30.020	29.992	29.978	29.991	29.998
August, . .	30.008	30.023	29.973	29.992	30.007	30.006
September, .	30.078	30.094	30.065	30.052	30.075	30.074
October, . .	30.021	30.042	30.006	30.006	30.028	30.021
November, .	30.091	30.097	30.061	30.057	30.067	30.075
December, . .	30.124	30.153	30.116	30.128	30.133	30.131
Annual means,	39.039	30.056	30.021	30.017	30.033	

The irregular and more striking variations of the mercurial column as connected with the prevailing atmospheric phenomena, cannot be shown in this summary, but would require a transcript of the entire journal. The regular semidiurnal or horary oscillations of the mercury are, however, distinctly manifested by these observations, although not made at the hours considered most favorable to that object. It will be seen that the mean range of this regular oscillation, as between 10 A. M. and 6 P. M., is .039 inches.

The annual mean of the mercurial column as deduced from all the observations is 30.033 inches.

During the first five months of the year, the indications of the barometer may have been slightly reduced by a trifling inclination in its position occasioned by the weight of mercury in the basin. Measures were then taken to prevent the recurrence of this derangement.

Table of the mean height of the Barometer, at the hours thereinmentioned.

1834.	6 A. M.	10 A. M.	2 P. M.	6 P. M.	10 P. M.	Monthly mean.
January, . .	30.230	30.250	30.223	30.230	30.256	30.239
February, . .	30.118	30.176	30.123	30.118	30.126	30.133
March, . .	30.193	30.246	30.184	30.153	30.199	30.195
April, . .	30.084	30.108	30.072	30.052	30.073	30.078
May, . .	30.020	30.050	30.035	30.019	30.049	30.035
June, . .	29.899	29.932	29.919	29.918	29.942	29.923
July, . .	30.084	30.105	30.062	30.065	30.073	30.078
August, . .	30.030	30.047	30.033	30.018	30.034	30.033
September, . .	30.175	30.181	30.154	30.138	30.127	30.162
October, . .	30.193	30.196	30.168	30.159	30.196	30.182
November, . .	30.091	30.117	30.078	30.079	30.098	30.094
December, . .	30.146	30.177	30.131	30.147	30.203	30.161
Annual means.	30.106	30.133	30.099	30.092	30.118	

Mean range of the semi-diurnal oscillation, as between 10 A. M. and 6 P. M. . . . . .041 inches.

Mean of the two years 1833 and 1834, . .040 "

Mean of all the observations in 1834, . 30.11 "

Do. " " " in 1833 and 1834, 30.07 "

Table showing the monthly maximum and minimum of the barometer for the years 1833 *and* 1834.

	1833.			1834.		
	Maximum.	Minimum.	Range.	Maximum.	Minimum.	Range.
January, .	30.49	29.32	1.17	30.65	29.65	1. in.
February, .	30.47	29.47	1.00	30.61	29.64	.97
March, .	30.52	29.57	.95	30.78	29.69	1.09
April, . .	30.40	29.42	.98	30.69	29.54	1.15
May, . .	30.37	29.72	.65	30.50	29.67	.83
June, . .	30.28	29.62	.66	30.23	29.34	.89
July, . .	30.25	29.65	.60	30.42	29.80	.62
August, .	30.22	29.70	.52	30.28	29.78	.50
September,	30.20	29.84	.46	30.60	29.71	.89
October, .	30.52	29.30	1.22	30.53	29.71	.82
November,	30.57	29.48	1.09	30.60	29.44	1.16
December,	30.50	29.50	1.00	30.56	29.45	1.11
Annual results	30.57	29.32	1.25	30.78	29.34	1.44

Of the monthly maxima of the barometer in 1834, $\frac{6}{12}$ occurred with the wind in the N. E. quarter; with the wind S. Easterly, none; $\frac{4}{12}$ with the wind in the S. Western quarter; and $\frac{2}{12}$ with the wind in the N. Western quarter.

Of the monthly minima, $\frac{3}{12}$ occurred with Northeasterly winds; $\frac{4}{12}$ with Southeasterly, $\frac{5}{12}$ with Southwesterly; and none with Northwesterly.

A barometrical journal, if made in connection with the observations now required by the Regents, would increase the interest of a scientific observer in the ordinary phenomena of the atmosphere, and may be otherwise of practical advantage. A full table of such observations, made at frequent daily periods, and, simultaneously, at some six or eight academies in different parts of the state, would increase the value of those reports for which the scientific world is already so much indebted.

It is respectfully suggested, whether barometrical reports to this extent may not be obtained by the voluntary action of gentlemen of science having charge of these institutions, and whether such a result may not be facilitated by furnishing, if necessary, a limited number of suitable instruments, to certain academies for this object. The barometers, if well selected, and once carefully adjusted in a secure position, are but little liable to derangement, and, where not already possessed, will prove a valuable acquisition to the philosophical apparatus of these institutions.

ART. XV.—*Meteorological Journal, for the year* 1834, kept at Marietta, Ohio, in Lat. 39° 25′ N. and Lon. 4° 28′ W. of Washington City; by S. P. HILDRETH.

Months.	THERMOMETER. Mean temperature.	Maximum.	Minimum.	Range	Fair days.	Cloudy days.	*Rain and melted snow.* Inches.	100ths.	Prevailing winds.	BAROMETER. Maximum.	Minimum.	Range.
January, .	27.17	62	0	62	22	9	5	37	W. N. W.	30.00	28 90	1.10
February, .	43.33	72	20	52	16	12	2	42	N. & S. W.	29.80	28.90	.90
March, . .	43.73	79	18	61	17	14	1	58	W. S. W. & S. E.	30.02	29.10	.82
April, . .	55.41	88	30	58	20	10	1	83	S. & S. E.	29.95	29.00	.95
May, . .	49.00	93	28	65	25	6	1	75	W. & S. W.	29.90	29.08	.82
June, . .	69.50	90	46	44	24	6	5	50	W. N. & S. E.	29.60	29.10	.50
July, . .	75.61	94	59	35	26	5	5	08	S. E. S. W. & N.	29.60	29.30	.30
August, .	72 20	95	47	48	30	1	1	33	N. for 22 days.	29.55	29.30	.25
September,	62.81	92	32	60	24	6	0	67	N. N. E. & S. E.	29.81	29.30	.51
October, .	50.11	78	22	56	21	10	3	75	N. & S. E.	29 80	29.00	.80
November,	43.33	75	18	57	16	14	3	25	W. & S. W.	29.80	29.00	.80
December,	36.66	58	16	42	14	17	2	13	W. E. & S. E.	29.90	29.10	.80
Mean, .	52.40				255	110	34	66				

The mean temperature for the year is 52.40, being two degrees less than that for the year 1833. The fluctuations of the barometer are not very great in this climate; the greatest range usually occurs in the winter or spring months. In the past year the greatest depression was on 12th day of January, with the wind from the S. E. during a heavy rain storm, it then remained at $28\frac{9}{1}\frac{0}{0}\frac{0}{0}$ inches for a number of hours, its greatest elevation was on the 9th of March, when it rose to 30.02. The rise is rarely above thirty, or depression below twenty nine inches. The mean height for the year is about 29.50, and range 1.10.

The quantity of rain and melted snow has been much less for the last year than the mean amount for the climate, being only $34\frac{6}{1}\frac{6}{0}\frac{6}{0}$ inches. The average for a series of years being forty two inches. The number of fair days has been two hnudred and fifty five, and of the cloudy only one hundred and ten, being less by thirty three, days than that of the year 1833. The mean temperature for the winter months is 35.72, for the spring months 49.38, for the summer months 72.03, and for the autumnal 52.08. The spring months have been unusually cold, nearly five degrees colder than those of the year 1833, while the winter period is more mild by nine and a half degrees.

The months of April and October are of nearly the same temperature in a series of years, but this year they differed more than 5°; April being unusually warm and had in fact taken the place of May, whose temperature was only 49° while that of April was 55.41. In 1833, the temperature of May was 67.17, making a difference of 18.17, a most appalling change when we consider its effects on vegetable as well as on animal life. April, from its commencement to the 25th of the month had been unusually warm; for many days the temperature was above 80°, on the 16th it was at 88°, and the mean for twenty four hours was nearly 70°, for several days. Peach trees in warm exposures were in bloom the 21st of March, and generally early in April. Every other tree was in the same state of forwardness, in proportion to their relative time of blossoming. Forest trees, by the twentieth of April, were nearly in full foliage and every other living plant was full of life and vigor, expanding its precocious leaves and blossoms to the stimulus of a tropical climate. Even the feathered part of creation, generally so safely guided by the all powerful direction of instinct, often more unerring than than that of reason, were lulled into security, and enticed much farter north, than they usually venture so early in the season. The severe cold which followed in May, proved very destructive to these beautiful creatures. Benumbed by the frost and cut off from their accustomed food, by the destruction, or retardation of the insect races, they perished by thousands. On the 26th of April the wind changed suddenly from its southern direction to the north, attended with a little rain, below the mouth of the Muskingum on the Ohio River; but above and north of that point, with snow. Severe frosts followed, which not only destroyed the early productions of the garden, but turned black, the foliage of the forest trees. Fruit trees were so full of leaves that many of the tender germs were yet preserved—mild weather, and gentle showers, the fore part of May, had encouraged and recruited the frost bitten vegetation to renewed efforts. Grape vines, which were just opening their blossoms on the 27th of April, by the 13th of May had so far recruited as to put forth a second series of foliage and flowers. Peaches and apples, where they had escaped, were of the size of an ounce bullet. On the 13th of May, a still more severe frost, or rather repetition of frosts, came down upon us from the north, attended with a dry, cold, blighting wind, and frost followed on frost until the 19th of the month. The forests, so lately clad in all their splendor, put on the appearance of winter. The branches and

boughs of many trees were killed, as well as the foliage, especially those of the white oak. All kinds of fruit both domestic and sylvan, were annihilated. The poor grape vines again suffered martyrdom, and some of the tender kinds were killed to the ground. It was useless to protect any thing in open exposures, with mats or blankets, the steady perseverence of "Jack frost," penetrated through all obstacles. A good brick wall, on an eastern exposure, saved me a few bunches of grapes, but the strawberries and raspberries were all destroyed. The white lilies, chinese peonies, and other beautiful plants suffered in the same way. Notwithstanding, all these freezings, here and there a few apples and peaches escaped, where protected by the river, or a hill. An orchard on an island in the bend of the Ohio, a few miles below Marietta, produced nearly a hundred barrels of apples. There is seldom any great evil without some alleviation. The total destruction of stone fruit, may perhaps also be the means of destroying the curculio. This insect, being of annual production, will thus have no suitable deposit for its eggs, whereby to renew the species.

The wheat crops suffered with the rest of the vegetable world. The head even where protected by the sheath, was so frozen as to be utterly destroyed in many situations. But a wise and kind provision of the Creator, has given this plant the property of throwing up new seed stems, where the first are destroyed, and even two or three in place of one; so that the crop was tolerably good, but considerably later in ripening. Some persons, not aware of this principle, plowed up their fields and planted them with corn. Rye being still more forward than the wheat, was in many instances entirely blighted and destroyed. Indian corn was all cut off to the ground, but would bear replanting where it did not again shoot up—with all this cold, there was also great severity of drought. Grass crops, were less than one third their usual amount. Potatoes, were very light and poor. The oat crop was tolerably good, and on new lands, and rich soil, Indian corn was much better than had been anticipated. On the whole the past year has been one that will long be remembered, and will form an interesting epoch in the history of the seasons in "the valley of the Ohio."

Marietta, Jan. 26, 1835.

P. S. The winter thus far, has been mild—on the 5th of January, the mercury sunk to 2° above Zero, which is the lowest—it re-

mained cold at night, but pleasant by day until the 13th, since then mild. Thermometer on the 25th at 62°. The rivers closed on the 6th, but opened on the 24th—only 1½ inches of snow in December, none in January, the absence of snow has preserved us from the severe cold of the middle and eastern states.

Art. XVI.—*Divisibility of Matter*; by E. Adams.

Hanover, N. Hamp., Dec. 18th, 1834.

TO PROFESSOR SILLIMAN.

Dear Sir—There has been, as we well know, much labored discussion, and much waste of ink upon the subject of the divisibility of matter. As the following has a bearing upon that point, and may be considered as a striking illustration of it; and as the result of my calculations was not a little surprising, as well as amusing to myself, and may be so to others; I send it to you, that you may, if you think fit, give it a place in your valuable Journal.

Several years since, as I was setting by my fireside, I observed several of my family around a table, reading by the light of a single candle. The thought occurred—how great a portion of the light of that candle is used by those several persons reading? And then immediately, a second thought—for how many persons does that candle furnish light sufficient to enable them to read, provided it could be so distributed, that the whole should be used for that purpose without any loss? The candle was rather a large one, and gave a very clear, bright light. I found on trial, that I could read very well with my book at the distance of three feet from the candle, and with my eyes nine inches from the book. The candle then would illuminate the concave surface of a sphere of three feet radius sufficiently for the purpose of reading. By measuring, I found that the book I made use of contained on an average twenty letters to an inch, and ten lines to an inch. But as the spaces between the lines were broader than the lines themselves, instead of ten, I supposed twenty lines to an inch, and, consequently, that four hundred letters would be contained in a square inch. A concave sphere then of six feet diameter would contain six million five hundred and fourteen thousand and four hundred letters. This number of letters the candle would illuminate, so that each would be distinctly visible to an

eye at the distance of nine inches. Here I would just observe, that the candle was supposed to be so philosophically made, that, whilst it maintained a constant bright flame, it did not intercept its light from a single letter in the concave sphere.

Again, the light, reflected from a single letter, would render that letter visible to an eye at the distance of nine inches not *in one direction only*, but to an eye placed any where in the concave surface of a hemisphere of nine inches radius. To how many eyes then, is the light reflected from one letter, sufficient to render it visible ?

I supposed the pupil of the eye to be one eighth of an inch in diameter, which is probably near the truth. On this supposition, the surface of a hemisphere of nine inches radius is equal to the pupils of forty one thousand four hundred and sixty five eyes. To this number of eyes, or to half this number of pairs of eyes, the light reflected from a single letter is sufficient to render that letter distinctly visible. But here it may be objected, and it is true, that to an eye, placed near the plane of the leaf, a sufficiency of light would not be reflected. But it is also unquestionably true, that not half the light, which falls upon the leaf, is reflected. The light, therefore, which is absorbed, would much more than compensate for this deficiency.

Now, the light, which falls upon a single letter, being sufficient to render it visible to 20,732 pairs of eyes, and the number of letters in the concave surface of a sphere of three feet radius being 6,514,400, the light which falls upon all these letters is sufficient for 135,056,540,800 pairs of eyes, or the light of one candle, should not a particle be lost, and the whole be so distributed, that each should receive his equal portion, is sufficient to enable 135,056,540,800 persons to read at the same time. If our earth contains 900,000;000 of inhabitants, and that, I believe, is the highest supposition ever made, the light of one candle is more than sufficient to enable all the inhabitants of one hundred and fifty such worlds to be reading at the same instant. This conclusion, I am aware, will appear to many, perhaps to most, altogether incredible. But any one, possessing but a moderate share of mathematical knowledge, may in a short time easily satisfy himself, that rejecting fractions, it is rigidly exact.

A candle like that, to which I have referred, would undoubtedly, continue burning at least four hours. What quantity of light then,

to be determined either by weight, measure, or the number of particles, will suffice for one person to read for one minute?

It will readily be perceived, that I have proceeded upon the supposition, that the Newtonian theory of light is correct.

ART. XVII.—*Botanical Communications*; by H. B. CROOM, Esq.

I. *Description of a New Plant.*

Anon. dioscoroïdes.

Calyx petaloid, 4 parted, expanding; corolla none; stamens four, large and somewhat quadrangular; berry 2 seeded? peduncles axillary, nodding, 2 flowered.

Plant herbaceous, very glabrous, about six inches high; leaves five to seven, crowded towards the summit of the stem, on long petioles, seven to nine nerved. Allied to Convallaria and Polygonatum? Mr. Nuttall, from a specimen which I sent him, has doubtingly called this plant a *Cissampelos*, but Dr. Pickering agrees with me in considering it to be different from that genus.

Found at Aspalaga on the Appalachicola, under the shade of the remarkable *Taxus* which I have before mentioned as existing at that place. Flowers in April.

II. *Localities of Plants.*

Hæc studia peregrinantur nobiscum.—Cic.

1. *Peucedanum ternatum*, Nutt.

Description. Whole plant glabrous; root tuberous; stem three to five feet high, striate and slender; leaves few, five to six, lower ternate, on very long petioles; leaflets narrow, three to four lines wide, linear, acute, attenuated at base; upper leaves simple, linear, acute, long; umbels one to nine, terminal and axillary; involucrum none, or from one to six narrow, linear leaves; radii elongated, six to fifteen; segments of the involucel three to six subulate, two to three lines long; pedicels filiform, about one inch long; petals pale straw color within, reddish brown without; filaments long; anthers large, two lobed; style reflected in the mature fruit; calyx five toothed, teeth acute, and probably deciduous.

Found by Dr. Loomis and myself near Newbern, N. C. (in the savannah, at the Race Course) with fruit and flowers, Sept. 28th.

2. *Rhexia lutea.*—Common in the savannahs around Newbern, N. C.

3. *Polygonum fimbriatum*, El.—(Three feet high; fringe of the stipules deciduous?) In the sand-hills seven miles north of Columbia, on the road to Camden. P. *polygamum* in the sand-hills between Camden and Cheraw.

Both species flowering in October.

4. *Cupressus disticha*, var. *imbricaria*. Nutt.

In the swamp and stream of Drowning Creek, thirty two miles S. W. of Fayetteville, N. C. Also in a pine barren pond five miles north of Camden, S. C.; on the Ocmulgee at Hartford, Ga. and in pine-barren ponds between the Ocmulgee and Flint Rivers.

5. *Calamintha caroliniana.*

In the sand-hills five or six miles S. W. of Camden on the road to Columbia. Also at Richmond Bath, Ga.

6. *Ceranthera linearifolia*, El.

Abundant in Dooly and Baker counties, Georgia, along the Flint River road. An aroma similar to that of peppermint is very abundant in this plant. Flowering in October.

7. *Chrysobalanus oblongifolius.*

In Decatur and Baker counties, Ga., along the Flint River road, flowering in June. Also in Middle Florida.

8. *Robinia rosea*, El.?

Along the Flint River road in pine woods—a thorny shrub from three to six feet high.

9. *Robinia nana*, El.

In the sand-hills of Wayne county, N. C., also in pine woods between Columbia and Augusta.

10. *Petalostemon corymbosum*, as far north as the sand-hills of Cumberland and Sampson counties, N. C.

11. *Eupatorium coronopofilium*, as far north as Cumberland, Sampson and Wayne couuties, N. C. Very abundant in the poorest soils along the Flint River road, and in Florida.

12. *Rosa suaveolens*, Ph.

On the road between Columbia and Augusta. Also in Lenoir County, N. C. rare.

13. *Sarracenia rubra*, in a broad swamp ten miles S. W. of Camden on the road to Columbia, along with S. flava.

14. *Sarracenia calceolata*, Nutt. (*S. pulchella*, nobis.) In wet pine woods two or three miles west of the Telogie on the road to Aspalaga.

15. *Sarracenia variolaris.* Frequent in wet pine woods of Florida and Southern Georgia.

16. *Sarracenia flava.*—From the southern borders of the Chesapeake Bay to the Gulf of Mexico, in swamps, savannahs, and wet pine woods.

Sabal Adansoni, in the swamps around New Orleans. I have already noted its existence as far north as Neuse River, N. C. Latitude 35° 20′. In Georgia I have noted it as far up as Hartford on the Ocmulgee.

18. *Iris cuprea* and *Crinum americanum* in swamps around New Orleans.

19. *Pancratium (rotatum?)* flowering in May. Very abundant on the Mississippi below New Orleans.

20. *Helenium quadridentatum*, Mich.? (Leaves broadly decurrent.) Very abundant on the Mississippi below New Orleans, flowering in May. I have noted the same plant on the Neuse River, N. C. and in Georgia between the Oconee and Ocmulgee Rivers. Along the Flint River road I have observed it with a few remaining flowers in October.

21. *Catalpa cordifolia.*

On the Conechee, about the 31st degree of latitude, native? See Ellicott's Notes.

22. *Gossypium.* (Cotton plant.)

Spontaneous near the southern extremity of the peninsula of Florida—seeds woolly.—G. hirsutum or G. barbadense? Reported to me by Mr. Wyatt of Tallahassee. The Cotton plant (G. barbadense?) is also spontaneous at Key West.

III. *Remarks on some parts of my former communications, and correction of some errors therein.*

In *Baptisia simplicifolia* the flowers (which I have since obtained) are yellow, the legumes pedicelled, leaves rhombovate, without stipules. Flowers in June.

Thyrsanthus floridana is probably only a variety of T. frutescens, El. (Wistaria speciosa, Nutt.)

Sarracenia pulchella is the S. calceolata of Nuttall, figured and described in the Trans. Am. Philo. Soc. I still think it may be the original S. psittacina of Michaux.

Sarracenia Catesbæi of Elliott, I now think, is only a variety of S. flava. An examination of the figure in Catesby's work, referred to by Elliott, has confirmed me in this opinion.

The *parasite tree*, figured in one of your late numbers, by Lieut. Long, is the same mentioned by me in a previous number, (October,

1833) as a "Phenomenon in vegetable life." These trees (Pinus palustris) are forty or fifty feet in height.

In *Malva Nuttalloides* the petals are *bright* purple, and not *dark* purple, as I have said, describing from a dried specimen in the Herbarium in which the petals had changed their color. This plant is not confined to the *pine woods*, but occurs also in the oaky forests of Florida. It is remarkably variable in its leaves, calyx, and pubescence. I subjoin an amended description.

Malva Nuttaloides.

Root perennial? stem prostrate or procumbent, branching, 1—2 feet long; leaves palmate, 3—5 lobed, lobes variable in form and length; petioles long, 3—6 inches; peduncles longer than the petioles; interior calyx five parted; exterior calyx three leaved, leaves lanceolate or linear, sometimes entirely or partially wanting; petals five, about one and a quarter inch long, one inch broad, obtuse, fimbriate, bright purple; capsules arranged in a circle, with a flattened disk; stem, leaves, calyx, peduncles, and petioles hairy, almost setose. In Florida and the southern parts of Georgia as far as Hawkinsville on the Ocmulgee. Flowers May—June. The peculiarities of this plant render it probable that *Nuttallia* is properly only a section of the genus *Malva*. Should this opinion be confirmed, all botanists will readily concur in dedicating some other genus to the memory of a man who has done so much in the investigation and illustration of North American Botany, and who is now periling his life in the prosecution of further discoveries.

At page 315 of this Journal, (July, 1834,) for "Peedee River" read "Santee River." At page 314 of the same number, for "Dr. McKee" read "Dr. McRee."

Art. XVIII.—*The Mole Carnivorous*;* by Sam'l Woodruff, Esq.

TO PROFESSOR SILLIMAN.

Dear Sir,—Under the article "Natural History" in the 17th Vol. of your Journal of Science, &c. p. 138, I read with much interest the "Natural History of the Mole." It appears conclusively

* The animal which in this country is commonly called a *mole*, is different from that which bears the name in Europe. The former is the *Scalops Canadensis* of Cuvier; the latter is the *Talpa Europæa* of Linnæus. In the second edition of Cuvier's Règne Animal, published in 1829, our mole (or *shrew mole*, as Godman calls it,) is classed under the order *Carnaria*, family *Insectivora*, which shows that

by the facts stated by M. Flourens, that this animal is *carnivorous*, and not *herbivorous*, contrary to what I had ever before supposed.

The multitudes of them in our gardens, in which we find so many potatoes, beets, carrots, parsnips, and other root vegetables eaten below the surface of the ground, in or near their arched lanes, confirmed me in the belief that they were the trespassers. This opinion prevails, as I understand, throughout our country.

In reading the statement of facts made by M. Flourens, I found myself under the necessity of doubting whether the moles with which his experiments were tried, might not be of a different species and of different habits from those of our country. This led me to a determination to try the experiment as soon as I could obtain a subject. In this, however, I did not succeed until the 13th inst., when at evening I procured a full grown, healthy and vigorous mole of the species commonly called the garden mole.

I confined him in a wooden box about two feet square, placing on the bottom six or eight inches depth of earth, and before him a potatoe, a beet, a carrot, a parsnip, turnip, and an apple.

Early next morning I found him exceedingly languid, and apparently exhausted, barely able to turn himself over when placed on his back. All the vegetables remained whole—none of them having been bitten. I then presented him the head and whole neck of a fowl, with the feathers on; he instantly seized it, and fed upon it with great avidity. I found him the next morning, plump, strong and active—nothing left of the head and neck of the fowl, except the beak, part of the skull, and bones of the neck, the latter being gnawed and stripped of all the flesh. I then left with him a whole chicken about the size of a quail. The next day, I found upon examination, nothing left of the chicken, with the exception of the beak, wing feathers, and a few of the larger bones. I then treated him to the head, neck and entrails of another fowl. He first devoured the entrails, and after that, the head and neck, with the exceptions as stated in the first instance. Satisfied with this course, I changed his regimen on the evening of the 17th, from flesh to cheese, with the ad-

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the nature of its food was then known. Concerning the state of the animal during winter, Godman's account,* which is the best we are acquainted with, is silent. The *Encyclopædia Americana*, art. *Shrew mole*, states that in winter "he burrows near streams where the ground is not so deeply frozen." We know of no further evidence on the subject. (Communicated.)

* Am. Nat. Hist. Vol. 1, and Rambles of a Naturalist.

dition of potatoe boiled with meat; the animal was then full and vigorous. The next morning I found him dead—the cheese and potatoe as I had left them, none of which had been eaten. The belly and sides of the mole were much contracted and depressed.

During the whole time of his confinement, he had been well supplied with water and ice. The whole of the vegetables put into the box remained unbitten.

The result of this experiment has removed from my mind all doubts respecting the character and habits of this singular animal—and whether the mole of our country, is or is not of the same species with those mentioned by M. Flourens, it is clearly not herbivorous, and may be truly ranked among carnivorous animals.

But a question of perhaps more difficult solution respecting the mole's digestive organs, and of its regimen in relation to its hibernation in our latitude, remains as a subject of enquiry. From what may be considered as already ascertained relative to their habits and regimen, I think it cannot be supposed they lay up in store their supply of provisions for the winter—nor can they, during the time the ground remains frozen, travel abroad in search of food, except it be below frost, and even there, no food proper for them could be found.

Do they belong to that class of animals which hibernate in a torpid state, and to which no food of any kind is necessary during the continuance of their torpidity? If so, where do they take up their winter lodgings? It is true they are sometimes found in an active state in cellars during the winter; but it can hardly be supposed they all find such accommodations, nor is it easy to conceive how, even in those situations, they should be able to find food of the proper kind to satiate their gluttony.

The mole in his subterranean march, possesses no physical power for migrating to the south, nor is it probable that the functions of his digestive organs cease their action, as in those animals which become torpid in their hibernation.

These hints are barely suggested, indulging a hope, should you give them publicity, that they may elicit from some able naturalist, a publication which shall settle the question.

There seems to be a general rule established in nature, (it may, like other general rules, have exceptions,) that all those animals, whose proper food can be acquired by them in the higher latitudes during the winter, do not migrate—such as eagles, hawks, owls, crows, and other carnivorous birds; also partridges, quails, various kinds of snow-birds, and many others which feed on buds of trees,

and shrubs, seeds of weeds, and berries of different kinds. But those which feed on worms and insects,—such as martins, king-birds, robins, blackbirds and many others, instinctively migrate to more southern latitudes, not being able to find their proper food here during the season of winter.

Another class of animals, natives and permanently resident in our latitude, have neither the power of emigration nor the means of obtaining food during our winters. These by a most wise and wonderful provision in nature, are so formed and organized, that they may retire to their winter lodgings, and remain in a torpid state, without inconvenience to themselves, during the frosts of winter, however long they may continue. *But to what class belongs the mole?*

There are certain peculiar properties belonging to this singular animal relative to its structure and adaptation to the condition in which nature has placed it, which deserve the notice of the naturalist. Of these, however, by reason of my limited knowledge of anatomy, I can give a very imperfect description.

The snout or proboscis which projects three fourths of an inch beyond the extreme point of the upper jaw, and consisting of a substance similar to that of the upper edge of a pigs snout, flexible and elastic, yet cartilaginous and sufficiently rigid to pierce the ground, serves as a *pioneer* to prepare and direct the way for the body. Next the fore feet or rather *paws*. These are very large, broad, and strong, furnished each with five long and powerful nails or talons. These feet are so organized that the back sides of them are easily brought into contact with the sides of the head and neck, to thrust aside the earth laterally. The shoulder blades lie longitudinally with the line of the body, nearly in contact with each other, forming a sort of shield for the shoulders, and are covered with a thick, muscular integument strengthened by tendons connected with the muscles of the fore legs, so that when the paws are moved in pressing aside the earth, a simultaneous motion, upwards, is given to the blades to resist the pressure of the superincumbent earth and faciliate the progress of the body.

The chest is broader and deeper than any other part of the body.

I send you herewith, the skin of the animal which was the subject of my experiment, stuffed with tobacco, the snout with the jaws, eyes, feet and tail entire. The examination of them, together with the imperfect description I have given may enable you, if you think them deserving your attention, to give a more correct, scientific and technical description of this humble animal, its habits and structure.

Windsor, Conn. Nov. 20th, 1834.

Art. XIX.—*On the Geology and Mineralogy of Schoharie, (N. Y.)* by John Gebhard, Esq.

The last number of the Journal, contains an article by Mr. C. U. Shepard, on the Strontianite and the limestone Cavern, of Schoharie, in which, is expressed a wish for additional information in relation to the occurrence of the Strontianite, and the names of the discoverers of our mineral localities. My communication is intended to supply these desiderata.

A Court house.—C Balls cave.—D Locality of Iron Pyrites.—9 Arragonite locality of Foxes Creek.—Shaded, Supposed extent of the water-lime.—White, Fertile alluvial lands.

The strata, known by the name of water-lime,* in this county, have within a few years been found to be the repository of interesting minerals. Its direction is North and South. It dips to the South at an angle of 1° 5′; and one half mile south of the Court house, it disappears below the valley, on both sides of the river. The figs. 1, 2, 3,

* Water-lime is, in this piece, used for the rock which by calcination, used in sub-aqueous constructions, affords the lime.

4, 5, 6, 7, 8, represent the mineral localities in the annexed drawing for the purpose of easy reference to Mr. SHEPARD's paper, and to show the order of discovery. No. 1 and 2, within a few rods of each other, are correctly described in page 364 as to the acicular crystals of Strontianite, with the omission in No. 2 of thin veins from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch thick, (supposed to be fibrous Celestine) traversing the water-lime, and coating the Strontianite, Heavy Spar and blue Calcareous Spar. The whole reposes on a silicious limestone, underlying greywacke, which itself rests on a compact limerock, containing favosites. I will observe here, as applicable to most of the localities, that there is a confused disposition in the approximating strata, which accounts for the different depositions of the mineral. The strata below No. 1 only, are fully exposed, and exhibit the greywacke and favosite-rock, alternating. No. 3 is within a few rods of the Court house. Its color is white; and it occurs in veins as described in pages 364 and 5. The upper stratum being removed, the loose fragments were found near the surface partially embraced by the water-lime. It reposes on the favosite-limerock, in which considerable masses are imbedded. No. 4 is an interesting variety, not noticed in the Journal:—Color blue, gray; massive; lamellar; often in cavities with tabular crystals. Indeed the mass is chiefly an aggregation of crystals, and so slightly cohering, as with difficulty to be removed from its bed. On exposure to a dry atmosphere they are less liable to separate. Below this, is a layer from one quarter, to one inch in thickness of fibrous Celestine (as we supposed.) It had the same tendency to separate, but acquired solidity by the same treatment; from which I infer that it may be the Heavy Spar mentioned on page 367. Here was an excavation of six feet in a blue limerock resting on a silicious limerock, the mineral reposing on greywacke, near the water-lime. No. 5, about forty feet distant, is correctly described on page 365. In reference to the small transparent crystals of Quartz disseminated through the Calcareous Spar, they occur only, I presume, when the mineral is found between the silicious limerock and greywacke, as it is here. It must be observed that the above localities are all found on acclivities in cultivated fields, where the superstratum is often partially or totally removed. The line of inclination carries the water-lime above the valley of Foxes Creek, two hundred feet to No. 6, which embraces the crystals of Strontianite, occurring in cavities or geodes, as described in p. 366. These cavities are found in a regular stratum of gray or blue Calca-

reous Spar, covered by water lime, and from three, to seven inches thick. When broken, the geodes are often empty, shewing the partial or total decomposition of the crystals; when filled with crystals, it is difficult to preserve them; as the force necessary to break the rock frequently separates them from the gangue. Below this, is a layer of Strontianite and Heavy Spar of a light blue color. It occurs massive, and lamellar. Another variety is massive, in thin laminæ, and often disintegrating. Another variety is a coating deposited on the water-lime and silicious limestone, about half an inch thick, and filled with small interstices giving it a spongy appearance. It is soft when removed from the quarry, but soon acquires hardness by exposure. In this locality are also, columnar forms, not very dissimilar to some varieties of favosite, found in the water-lime and blue limerock. This locality underlies the water-lime, and is based on the silicious limerock and greywacke. The water-lime and the various strata directly above and below in the different localities, contain no organic remains except favosite. Thus far, the order of the strata alluded to in p. 263 is not materially inapplicable; and they contain the same petrifactions, (except the lilly, and stag-horn encrinite.) The water-lime is not seen again until we arrive at the bottom of Ball's cave, four miles N. E. of the Court house. When this cave was discovered, it contained numerous stalactites and stalagmites, many of which were of the purest white alabaster, also fibrous and columnar Arragonite, Satin spar, and a few specimens of Pisolite occurring in oval concretions, about the size of a hazle nut, with distinct concentric layers, found in cavities in alabaster. The chemical character of the cave minerals has not, in all instances, been satisfactorily ascertained. The inclination of the water-lime on the west side of the river (the whole mountain range being the same,) is similar to that on the East; but its edges are less exposed, being covered with the detritus of the superincumbent rocks for about three miles. The massive Strontianite, (called the marble quarry) No. 7, is at the base of a high ledge of rocks, and is covered with water-lime about five feet thick, which reposes on a blue limerock, destitute of organic remains. Its approach is difficult and dangerous. The ascent of the acclivity from the valley of three hundred feet is effected only by the aid of shrubs and depending limbs, while the descent from above, of one hundred feet, is no less dangerous. In tracing the direction of the water-lime which passes over the valley of Cobleskill Creek to No. 8 in the town of Carlisle, about seven miles, the strata ap-

pear in superposition, as follows; water-lime—corniferous limerock and soft argillaceous slate, (second greywacke) traversed by the Heavy Spar and fibrous Arragonite. This locality was visited by Prof. EATON about fifteen years since, who then pronounced it Heavy Spar, without distinguishing from it the fibrous Arragonite. Recent examinations prove the slate to be between ten and fifteen feet thick, and traversed in numerous veins by the same mineral. One mile south, the Heavy Spar is found unaccompanied by rocky strata.

In 1829, JOHN GEBHARD, Jr. discovered No. 1 a locality of acicular Strontianite; and having no means of analysis, pronounced it Calcareous Spar. Soon after, he found specimens of a clayey limerock with small crystals imbedded near the surface. Also incrustations were found on the blue limerock, consisting of minute crystals, diverging and radiated, and penetrating the rock. These indications invited more critical investigation, which terminated in the discovery of No. 3 of massive Strontianite and Heavy Spar, about half a mile distant from the former locality. It was then ascertained that these localities were situated in the water limerock, by pursuing which, he discovered Nos. 2, 4 and 5. The above embrace all the important localities. There are others, particularly No. 6 on the north side of the Foxes Creek, all referable to a knowledge of the gangue for their discovery. No. 7 (the marble quarry) was discovered about twenty years since, and soon after the above discoveries, was examined by JOHN GEBHARD, Jr. and others; and being found connected with the water-lime, it was regarded as a similar mineral.

The locality of Iron Pyrites, one mile west of the Court house extends along the west bank of the river about one hundred rods, with perpendicular strata about thirty feet in height. The upper stratum is shelly limerock, reposing on silicious limestone, associated with a dark, oolitic rock colored by the Pyrites; below this, is a soft, blue slate from ten, to fifteen feet in thickness, within which is the chief deposit of the mineral; it is traversed by a thin vein of fibrous Heavy Spar. By sinking a shaft eight feet lower in search of coal, a black, soft, unglazed shale (bituminous) was found, alternating with the silicious limestone and oolitic rock. Below the upper stratum, no organic remains are found. This locality exhibits the Iron Pyrites in numerous forms. About one half of a mile north, the Iron Pyrites is found accompanied by similar strata. About four miles distant on the banks of the Cobleskill Creek in a north west direction, they are found in a similar state with the like

strata. On the east side of the river, at the base of the mountain, is another locality. The Iron Pyrites here, is an abundant mineral, but these distant localities corresponding in strata, and horizontal position, can leave no doubt of the existence of extensive beds.

The strata on either side of the river of equal height may be called equivalents, not only in appearance, but as to petrifactions. In fact, the similarity of the rocks induce a belief that they were once united and separated by some convulsion, or else, that the valley was formed by violent inundations.

Loose fragments and bowlders from primitive regions are every where found on our mountains, particularly, Granite, Gneiss and Hornblende-rock, which contain Garnet, Pyroxene, Scapolite and Epidote.

Bog iron ore in great quantities is found two miles south of the Court house in a marly clay. Septaria from the Schoharie river, four miles south of the Court house, from five to twenty six inches in diameter, of a dark blue color, finely checkered with seams of Calcareous Spar, and a dark brown oxide of iron.

A locality of lenticular Calcareous Spar exists one mile N. E. of the Court house; and Fluor Spar in narrow seams traversing a stratum of clay in laminated Calc. Spar one fourth of a mile south of the Court house. Near the same place, fourteen feet below the surface, the water-lime was excavated and found to be similar in fracture, and not inferior in quality to the lithographic stone of Papenheim, Germany.

Novaculite, in large bowlders, color greenish gray, fracture splintery, highly esteemed for hones, is common.

In excavations for coal, recently made, five miles south of the Court house, the Encrinite, Orthocera and bivalve shells were found in a glazed slate and bituminous shale, invested with Iron Pyrites, which often composes the substance of the petrifaction. A locality of Arragonite exists near Foxes Creek, three miles N. E. of the Court house, on a steep acclivity at the foot of a rock, three hundred feet above the valley,—affording fine specimens of the parallel diverging and radiated varieties.

Calcareous Tufa is found in great abundance on the sides of our mountains from five to fifteen feet in depth, containing fine impressions of leaves, and covering grasses and mosses with incrustations so delicate as to preserve distinctly every fibre. Old deposits are frequently covered with vegetable loam on which shrubs and trees are growing.

An extensive slate quarry exists in the town of Blenheim, twenty mielss outh of the Court house, affording superior hones and whetstones. The greywacke is converted into grindstones in the neighboring towns of Blenheim, Cobleskill and Fulton. The Favosite alluded to in the Strontianite localities is advantageously polished for ornamental purposes, exhibiting a finely variegated surface. The specimens found in the above localities only, are susceptible of a fine polish.

Anhydrite is found in the town of Sharon, at the Sulphur Springs, seventeen miles west of the Court house.

MISCELLANIES.

DOMESTIC AND FOREIGN.

1. *Cold of January*, 1835.*—1835,† Jan. 8, New York City, −7°, 6 o'clock A.M.

Jan. 4, Sunday, Albany.—At the Academy, highest part of the city, 7 A. M. 23° − 9, 20° − 10, 17° − 12 M. 8° − 1 P. M. 2° − 2, 1° + 3, 2° +. At sunset below 0.

In the lower parts of the city, the cold was still more intense.

At Gen. Van Rensselaer's Manor House, at 6 A. M. 32° −.

At Gen. S. Van Rensselaer's, Jr. at half past 7 A. M. 32° −.

At Edward Brown's, Steuben Street, at 7 A. M. 31½° −, colder by 4° than by the same standard thermometer, on the cold day of 1817.

At the office of the Albany Argus, western exposure, at 9 o'clock A. M. the mercury was 25° −, at sunset 3½° −.

The coldest weather on record in Albany, prior to Sunday, Jan. 4, 1835, was on Sunday, Jan. 21, 1827, when it was 23° −, not so cold by 9° as on the 4th instant.

Snow every where a foot or more deep—fine sleighing—rail roads obstructed—cars could not move.

At Montreal, 35° −.

Harbor of Boston frozen down to Fort Independence, those of Portland, Newburyport, New Bedford, New Haven, Philadelphia, Baltimore and Washington frozen over.

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* Chiefly from the papers of the time. † New York City, Feb. 10, 1817, −10°.

Saturday and Sunday, Jan. 3 and 4.—Potomac at Washington frozen over firm enough for carriages to pass.

Jan. 5, Washington, at sun rise, 16° –.

It was the greatest cold, says Mr. Craig of the patent office, which he has observed in forty years.

The coldest weather observed at Baltimore in sixteen years.

Sunday, Jan. 4, 1835, Pittsfield, Mass. 32° – ; people went to church at 10 A. M., at 22° – ; all day did not rise above 1° –, and at eve sunk to 15° – . The air still, and the cold not severe to sensation, as on a subsequent day when it was only 0, but windy and clear.—*C. Dewey.*

Detroit, (*Mich.*) *Jan.* 4 & 5, 1835. No thermometer lower than +1°; on the 7th it was −5°, on the 8th −4°, which were the lowest.—*Major Whitimg.*

Marietta, (*Ohio*,) *Jan.* 5. +2°, which was the coldest day; the rivers closed on the 6th, but opened on the 24th; in Dec. 1½ inch snow.—*Dr. Hildreth.*

In the Southern States, very severe cold; at 0, or near it in Charleston, S. C., and in many other places, causing much suffering.

From a Meteorological Register kept at Hanover, New Hampshire and forwarded to us by Prof. Adams, it appears that on the 10th of December, the mercury being at 10+ at sun rise, sunk to 3° — at noon, and to 9° — at 9½ P. M., the mercury fell 5° in one hour, and 40° in twenty four hours.

Mean pressure of the atmosphere, -	-	29.44 inches.	
Greatest pressure, -	- - -	29.82	
Least pressure, -	- - - -	28.85	
Range of the barometer,	- - -	.97	
Fair days, -	- - - - -	-	3
Cloudy days,	- - - - -	-	17
Variable days,	- - - - -	-	11
Coldest day, 26th,	- - - -	−16°	2′ 3″
Warmest day, 3d,	- - - -	33	40 35
Range of the thermometer,	- - -	56	
Mean temperature at sun rise,	- -	14	
Do. do.	at 1½ P. M. -	-	24
Do. do.	at 9½ P. M. -	-	17½
Do. do.	of the month, -	-	18½

On the 21st, there was an Aurora Borealis, the altitude of whose arch was 9° above the horizon.

The following table (being drawn up with great good judgment,) we insert entire with most of the remarks annexed.

Meteorological Register for January, 1835, kept at Dartmouth College.

Days.	THERMOMETER. Sun rise.	1½ P. M	9½ P. M.	FACE OF THE SKY. Sun rise.	9½ P. M.	1½ P. M	WIND. Sun rise.	1½ P. M	9½ P. M.	BAROMETER. Sun rise.	9½ P. M.	REMARKS.
1	—1	8	6	fair	fair	cloudy	N. W.	N. W.	N. W.	29.43	29.37	
2	8	19	4	cloudy	"	"	N.	N.	N.	29.23	29.45	Snow 2 inches.
3	—9	0	—15	fair	"	fair	N. W.	N. W.	N. W.	29.52	29.76	
4	—32	—7	—20	"	"	"	"	"	"	29.76	29.68	*Aurora bor. very
5	—26	7	5	"	"	cloudy	s. w.	N. E.	N E.	29.64	29.62	brilliant—alt. 15°.
6	—6	3	—7	"	"	fair	"	N. W.	N. W.	29.72	29.72	
7	—16	2	—10	"	"	"	N. W.	"	"	29.71	29.67	
8	—23	3	—4	"	"	"	"	"	"	29.67	29.67	
9	—12	10	—6	"	"	"	"	"	"	29.68	29.26	
10	—12	13	—1	"	"	"	"	"	"	29.71	29.75	
11	—12	16	1	"	"	"	"	"	"	29.71	29.62	[45° in diameter.
12	—8	21	6	"	"	"	"	N. E	N. E.	29.58	29.42	Halo round the m'n
13	6	31	24	"	"	cloudy	s. w.	s. w.	s. w.	29.33	29.31	Hazy. [hours.
14	26	38	34	cloudy	cloudy	"	s.	"	"	29.25	29.10	Rain from 1 P. M. 10
15	33	44	39	"	"	"	N. W.	"	"	29.27	29.20	High wind. Rain.
16	34	41	35	"	"	"	s. w.	"	"	28.83	29 04	Snow in the night,
17	34	38	32	"	"	"	N. W.	N. W.	N. W.	29.17	29.38	5 inches. Rain.
18	24	26	13	"	fair	fair	"	"	"	29.41	29.47	Aurora. [Windy.
19	4	25	17	fair	"	cloudy	"	"	"	29.49	29.36	
20	22	29	31	cloudy	cloudy	"	s. w.	s. w.	"	29.22	29.31	[in. and rain.
21	16	32	28	fair	"	"	"	s. E.	s. E.	29.35	29.00	Snow from 2 P. M. 6
22	35	37	32	"	"	"	W.	W.	s. w.	29.68	29.99	Windy. [ra.
23	29	35	28	cloudy	"	"	"	"	N. W.	29.00	29.31	High wind. Auro-
24	20	23	9	fair	fair	fair	N. W.	N. W.	"	29.47	29.78	[inches. Rain.
25	8	25	27	cloudy	cloudy	cloudy	s. w.	s.	s.	29.70	29.28	Snow from 1 P. M. 3
26	31	47	31	foggy	fair	foggy	s.	"	s. w.	29.05	29.00	Ther. at 3 P. M. 81°.
27	32	42	26	"	"	fair	"	"	"	29.05	29.24	Snow 2 in. & rain.
28	32	38	35	cloudy	"	cloudy	"	"	"	29.15	29 20	Rain in the morn.
29	27	33	19	fair	"	fair	N.	N.	N.	29.54	29.70	Aurora bril. al. 17°.
30	23	32	34	cloudy	cloudy	cloudy	s. E.	s. E.	s. E.	29.56	29.05	Snow and sleet 7 in.
31	44	44	32	"	"	"	s. W.	s. W.	N. W.	28.56	28.72	Heavy rain. Rain till sun rise. Barom. fell 1.14 in. in 38 hours.

Mean pressure of the atmosphere, -			29.377 inches.
Greatest pressure, - - - -			29.78
Least pressure, - - - -			28.56
Range of the barometer, - - -			1.22
Fair days, -	11	Cloudy days, - -	8
Variable days,	12	Snow or rain, (usually both,)	9 days.

* It may be observed that on the morning after this Aurora, there was a south west wind. It is said by English Meteorologists, that a wind from the south west usually follows soon after the appearance of the Aurora.—It appears that the storm which commenced here Dec. 30, began at Washington twenty four hours earlier than at this place; the snow also fell to a greater depth,—there having been twenty inches at Baltimore, fifteen at Boston, and only ten at this place. It is worthy of remark, as first proved by Dr. Franklin, that storms generally advance against the wind.

Mean temperature at sun-rise, - - - $10\frac{1}{3}$°
Do. do. at $1\frac{1}{2}$ P. M., - - $24\frac{1}{3}$
Do. do. at $9\frac{1}{2}$ P. M., - - $18\frac{1}{3}$
Do. do. of the month, - - $17\frac{2}{3}$

Coldest day, 4th, - - - -	−32	−7	−20
Warmest day, 31st, - - -	44	44	32

Range of the thermometer, - - - - 79°
Do. do. exposed to the effects of free radiation and to the sun, - - - 114°

A List of the temperature of different places on the morning of the 4th, is annexed. In some instances, where the cold was most intense on the 5th, the temperature of that day is given.

Salem,	−17	Saco, Me.	−28	Albany, N. Y.,	−32 Gen. V. R.'s
Dorchester,	−22	Concord, N. H.,	−35	Saratoga,	−33
Boston,	−15	Newport,	−43?	Poughkeepsie,	−33
Newburyport,	−13	Lancaster,	−35	Utica,	−34
Portsmouth, N. H.,	−20	Newbury, Vt.,	−36	Schenectady,	−33
New Haven, (5th)	−23	Bradford,	−38	Montreal, L. C.,	−35
New York,	− 5	Norwich, (H. Bridge)	−36		
Newark,	−13	Rutland,	−30	Bath, Me.,	−40
Elizabethtown,	−18	Burlington,	−26	Bangor,	−40
Baltimore,	−10	Windsor, (5th)	−24 (4th) −34	Franconia, N. H.,	−40
Philadelphia, (5th)	− 4	Concord, Ms.,	−27	White River, Vt.,	−40
		Lowell,	−24	N. Lebanon, N. Y.,	−40
		Worcester,	−19	Montpelier, Vt.,	−40
		Hartford, Conn., (5th)	−27	Newport, N. H.,	−40 (probably)

Of these places, those in the first column are all either seaports or towns situated very near the sea. They are presented separately from the others, to show the influence of vicinity to the sea upon climate. The towns named in the second column and part of the third are variously situated in the interior. The remainder are classed by the temperature. Most, if not all of them are situated at the bottom of deep and narrow vallies; they afford a good illustration of the remarks in the Register for December, upon the coldness of low places.

A few mean temperatures of portions of the month are annexed, as they may be interesting to readers, from the uncommon severity of the first part of the month, and the remarkable change, from the influence of which the health of the community is still suffering.

Mean temperature of 7 days, beginning Saturday, the 5th, −8

Do. do. of the first 12 days, at sunrise,			$-12\frac{1}{2}$
	at $1\frac{1}{2}$ P. M.,		$-7\frac{1}{2}$
	at $9\frac{1}{2}$ P. M.,		$-3\frac{1}{2}$
	of the whole,		$-2\frac{3}{4}$

Mean temperature of the cold week, beginning Sunday, the 4th,	at sunrise, - -	$-18\frac{1}{7}$	
	at $1\frac{1}{2}$ P. M., - -	$-3\frac{5}{7}$	
	at $9\frac{1}{2}$ P. M., - -	$-6\frac{1}{7}$	
	of the week, - -	$-7\frac{1}{7}$	
Mean temperature of the last 19 days,	at sunrise,		$25\frac{1}{4}$
	at $1\frac{1}{2}$ P. M.		35
	at $9\frac{1}{2}$ P. M.		$27\frac{3}{4}$
	of the whole,		$29\frac{1}{3}$

From the Connecticut Journal.

The following extracts from a Thermometrical Register kept by the late President Stiles at Yale College for a period of twelve years, will serve to show that what in former times have been called severe winters, will not compare as to intensity, with the cold of last week, on the Monday of which, several different thermometers in this city stood at 24°, and one at $26\frac{1}{2}$° below cypher.

Every instance is given, in which the thermometer fell as low as cypher, and in those winter months in which it did not descend so low, the lowest degree of cold for that month is specified. H.

1780.—Jan. 23, $3\frac{1}{2}$° − at 9 A. M.; 29, 1° − at sunrise.—Feb. 6, coldest this month 6°+.—Dec. 29, coldest this month, 13°+.

1781. Jan. 8, coldest this month $13\frac{1}{2}$°+. Feb. 12, 0 at sunrise.* Dec. 19, coldest day this month 15°+.

1782. Jan. 30, 5°−, at 8 A. M.; 31, $5\frac{1}{2}$°−, half past six A. M. Feb. 1, coldest day this month, 2°+. Dec. 16, coldest day this month, 11°+.

1783. Jan. 9, $7\frac{1}{2}$° − at sunrise; 15, $2\frac{1}{2}$° − at half past nine P. M. Feb. 3, 8°− at 7 A. M. Dec. 20, coldest day this month, 13°+.

1784. Jan. 9, $1\frac{1}{2}$° − at 8 A. M.; 16, 0 at 10 A. M.; 17, $2\frac{1}{4}$° − at sunrise. Feb. 9, 2° − at sunrise; 10, $8\frac{3}{4}$° − at sunrise; 13, 7° − at 8 A. M.; 14, 7° − at 7 A. M.; 15, 6° − at 7 A. M.; 16, 6° − at 8 A. M.; 29, 1° − at 7 A. M. March 1, 0 at 9 A. M.; 2, 3° − at 7 A. M. Dec. 23, 1° − at sunrise.

1785. Jan. 31, $\frac{3}{4}$° − at 7 A. M. Feb. 4, coldest day this month 9°+. Dec. 29, coldest this month, 6°+.

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* *Note by President Stiles.*—From 7th to 13th, surveyed the harbor on the ice, to five-mile point.

1786. Jan. 18, 4° – at 7 A. M.; 19, 4° – at 8 A. M.; 20, 3° – at 9 A. M. Feb. 26, coldest day this month, 5°+. Dec. 12, $5\frac{1}{2}$ – at 8 A. M.

1787. Jan. 19, coldest day this month, 4°+. Feb. 5, coldest day this month, 5°+. Dec. 16, coldest this month, 18°+.

1788. Jan. 14, 3° – at 8 A. M. Feb. 5,* 6° – at 10 A. M.; 6, 4° – at sunrise. Dec. 25, 6° – at 8 A. M.

1789. Jan. 10, coldest day this month, 5°+. Feb. 2, 12° – at 7 A. M.; 5, 1° – at 11 P. M.; 6, 8° – at sunrise. Dec. 13, coldest day this month, 13°+.

1790. Jan. 6, coldest this month, 10°+. Feb. 10, coldest this month, 1°+. Dec. 18, 2° – at half past ten P. M.; 10, $7\frac{1}{2}$° – at sunrise.

1791. Jan. 2, coldest day this month, 1°+. Feb. 17, coldest day this month, 1°+.

Montpelier, Vermont, 1835.

Saturday, Jan. 3, 9 o'clock, P. M.	30° below zero,	
Midnight,	36	" "
Sunday, Jan. 4, 3 o'clock, A. M.	38	" "
7 o'clock, A. M.	40	" "

By this it will be seen the mercury fell at 7 o'clock on Sunday morning to forty degrees below zero, or the point of congelation. Other thermometers in this place showed nearly the same results. We have no accounts of mercury ever having congealed before in New England. At Quebec, it is said it has been known once or twice to have done so. It is probable that the cold was several degrees greater in this village than in the higher places in the vicinity, inasmuch as in still times it has been found that the lowest places are some degrees the coldest—a fact not unknown, we believe, in the annals of Meteorology.†

A friend has favored us with an extract from a meteorological Journal kept in this town, (New Haven) nearly seventy years ago, by which it appears that the cold was as great as now. It mentioned

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* *Note by President Stiles.*—This day, the memorable cold Sabbath, Feb. 21, 1773, and the cold Tuesday, (Feb. 15,) 1731—2, the three coldest days in New England for seventy years past.

† In this extract from a Montpelier paper of Jan. 12, the writer does not say, in so many words, that the mercury froze, but we are left to infer it. As to the greatest cold being in the lowest situations, in a still atmosphere this must of course happen, for the coldest air, from its weight would necessarily subside.—*Ed.*

among other remarkable occurrences, that the weather had been two or three degrees colder than had been known for thirty years preceding. The degrees *in extreme cold* by the thermometer, were as follows:—

Dec. 31, 1766,	extreme cold, deg.		16
Jan. 1, 1767,	"	"	25
2, "	"	"	26½
3, "	"	"	18

5, there fell a very heavy and warm rain.

We take it for granted that the extreme cold here intended, is below 0; otherwise the phrase could have no reasonable meaning. The coincidence in time of the year and in intensity with the late severe cold, and the occurrence of a deluge of warm rain immediately after it, are very remarkable.

It was the same season in which died the eminent President Clap, the author of a theory of meteors.

At Philadelphia, Jan. 1, 1767, the mercury in the thermometer was 1½° below 0; on the 2nd, 2½°; on the 5th, 48 1° above. Various statements have been made in the papers, that the mercury had frozen in different places in the late cold, as at Bangor, Montpelier, Newport, Me. &c., but we have seen no statement sufficiently precise and authenticated, to command full belief, although we must presume that the mercury did congeal in some places.

We should be glad to receive more correct information on the subject. It might be difficult to be quite sure of the fact, without breaking the bulb, although it is remarked in the Dartmouth record, that the freezing of mercury may be known "by its having a leaden color, and a crystalline appearance."

2 *Notice of extraordinary seasons of cold.*

To the Editors of the Connecticut Journal.

Gentlemen,—If you think the following relation of facts selected from my History of Diseases, or supplied by my own knowledge, to be of any value, it is at your service. N. Webster.

Winters of uncommon severity.—Anno Romæ, 356. The winter was uncommonly cold; the streets in Rome were obstructed with snow, and the Tiber was covered with ice, so as to be rendered innavigable.—Liv. lib. 5. 13.

Another instance is mentioned, in a subsequent period, when the snow lay in Rome forty days.

In the year '29, before the Christian era, Horace attempts to dissuade Augustus from resigning the empire by mentioning certain omens and phenomena, among which was the great quantity of snow.

Jam satis terræ nivis, atque diræ grandinis misit pater, &c.

Other instances are mentioned of severe winters in Italy, but they were noted as *uncommon* phenomena; showing that the few instances mentioned, are no evidence that there has been any change in the temperature of that climate in modern days. Livy in writing of such a hard winter, calls it "*insignis annus*," which he would not have done, had severe winters been common.

In the year of Christ, 153, the Thames in England and all rivers were covered with ice.

A. D. 173, the snow in England covered the earth for thirteen weeks.

A. D. 400, the Euxine was covered with ice for twenty days.

A. D. 859, the Adriatic was covered with ice.

A. D. 929, the Thames was frozen for thirteen weeks.

A. D. 1263, and 1269, the Thames was covered with ice, so that horses and carriages passed over the river upon it.

A. D. 1607—8, the weather was so severe as to cover the Thames with ice, and boats were built on it.

It appears that similar winters have occurred in every period of authentic history—several of them every century.

The first winter of uncommon severity in New England, after the pilgrims arrived, was in 1642, when the harbor of Boston was covered with ice, so that teams passed from one isle to another. Indeed the ice extended so far at sea, that at Boston no water was to be seen.—*Winthrop*, 240, 243.

A. D. 1696—7, Loaded sleds passed on the ice from Boston to Nantasket.

A. D. 1683, The winter in Europe and America was very severe. It is related that in Europe, trees burst open, or were split by the intense cold.

A. D. 1708—9, In New England, the winter was nearly of the same severity. So intense was the cold on the 14th of December, that the day was not forgotten during the generation then living. Trees, grain, and vines were killed.

In February, 1717, fell the greatest quantity of snow ever known to fall in one storm. The depth cannot be ascertained with exactness; but it was several feet. In Boston, people went out of their

chamber windows, in the morning, upon rackets, snow shoes. Farmers had no way to get wood, but by walking upon rackets. John Winthrop of New London lost eleven hundred sheep on Fisher's Island, where they were buried in snow sixteen feet deep. Two of the sheep, however, survived, being taken out alive, after being covered twenty eight days. They lived by chewing the wool of the others; but after being relieved, their own wool came off. See Winthrop's Letter, Historical collection, vol. ii, p. 12. I do not find it mentioned that the cold of that winter was of unusual severity.

In 1788—9, the Seine in France was covered with solid ice for several weeks.

The winter of 1741 was of great severity. My father, who was a witness of the winters of 1741 and 1780, considered the cold of the former quite equal to that of the latter. But I have seen no thermometrical observations made in New England in the year 1741. By Mr. Jefferson's observations in his notes, it appears that the winter of 1780, was the most severe, as in 1740—41, York River was not frozen over, whereas in 1780, the Chesapeake was covered with solid ice from its head to the mouth of the Potomac. At Annapolis, where the bay is more than five miles wide, the ice was five inches thick.

In the winter of 1779—80, the first snow storm occurred about the 25th of November, and subsequent falls of snow raised it to the hight of three or four feet upon a level. The wind for several weeks from the North West was cold, the snow was so dry and so continually driven by the wind, that no good path could be made, and traveling was almost impeded. I passed often, half a mile or a mile on drifts as high as the fences. Farmers could do little else abroad than feed their cattle and provide them with water. For about six weeks the cold was so intense, that no snow melted on the south side of buildings. The sound between Long Island and the main was nearly all covered with ice, and troops of horse and heavy cannon passed on the ice between New York and Staten Island. Since that, as in 1788, the ice in the east river has been passable for a footman, for a few hours only at a time.

Thermometrical observations made at Hartford, on Fahrenheit's scale.

Jan.	1, 1780, at sunrise,	2° +	Jan.	19	13° —
	2	7° —		20	5° +
	3	14° +		21	6° —
	4	16° +		22	5° +
	5	6° +		23	9° —
	6	10° +		24	6° +
	7	9° +		25	16° —
	8	1° —		26	6° —
	9	5° +		27	2° —
	10	19° +		28	8° —
	11	26° +		29	20° —
	12	11° +		30	15° +
	13	8° +		31	4° —
	14	9° +	Feb.	1	2° +
	15	15° +		2	3° +
	16	10° +		3	0
	17	17° +		4	15° +
	18	12° +		5	8° —

State of the Thermometer, February, 1784 at Hartford.

Feb.	10	19° —	Feb.	14	20° —
	11	12° —		15	12° —
	12	13° —		16	16° —
	13	19° —		17	16° —

The latter is the most extraordinary instance of a continuation of intense cold that I have ever known.

My thermometer purchased in London and warranted to be correct, is graduated only to 20 degrees below zero. At sunrise on Sunday morning, the 4th inst. the mercury was at 12 degrees under zero—and at sunrise on Monday the 5th, the mercury had sunk into the bulb: at eight o'clock it had risen to 19. The degree of cold therefore was, by that instrument, about the same as that indicated by others, viz. 22 or 23 degrees below zero—the most intense cold which has been known in New Haven since thermometers have been much in use.

By many observations I have made, I have ascertained that in severe weather, the mercury at Hartford falls from 5 to 10 degrees lower there than at New Haven.

It was remarked that in the severe winter of 1780, almost all the birds of the forest perished. Here and there only, a solitary warbler was heard the next summer.

Winters of the utmost severity occur but three or four times in a century. Very mild winters are equally rare.

It is mentioned in history that in one instance, two or three hundred years ago, there was really no winter in Europe, and in the spring following, the wheat in the north of Europe was harvested in May. In 1755—6, troops were transported by water from New York to Albany, in January and February. In 1795, ladies walked upon the battery on Christmas day, without shawls.

In February, 1779, I saw farmers ploughing their fields in the county of Hartford, in the month of February.—*Jan.* 1835.

3. *Abstract of Meteorological observations, taken at Penn-Yan, N. Y., by* Doct. H. P. Sartwell, *for the year* 1834.

	THERMOMETER.						ATMOSPHERE.								
MONTHS.	Mean temperature.	Maximum.	Minimum.	Monthly range.	Warmest day.	Coldest day.	Fair days.	Cloudy days.	Variable days.	No. of days on which rain fell.	No. of days on which snow fell.	Depth of rain. Inches. 100ths.	Depth of snow. Inches. 100ths.	No. of days on which thunder and lightning occurred.	Prevailing winds.
January,	23.91	47	−4	51	17	5	10	11	10	3	3	.39	1.25		w. s.w.&n.
February,	35 15	65	0	65	22	8	11	7	10	4	4	.48	4.50	1	w.&s.
March,	36.55	68	11	51	20	22	10	12	9	6	5	1.28	7.12		s.&n.w.
April,	49.47	76	20	56	16	27	17	10	3	10	2	1.52	2.50		w.s.w.&n.w.
May,	56.45	87	26	61	23	14	14	8	9	10	3	3.00	4.00	4	w.&s.
June,	64.89	82	46	36	9	2	12	9	9	14		3.74		4	n.&w.
July,	73.28	94	46	48	9	30	20	3	8	8		2.69		4	w.&s.w.
August,	68.82	91	42	49	12	27	19	5	7	8		1.31		7	w.&s.
September,	60 94	86	29	57	4	29	17	4	9	10		2.09		1	w.s.&n.w.
October,	46.87	75	22	53	18	25	12	6	13	10	3	3.33	.50		w.s.w.&n.w.
November.	37.86	56	14	42	10	15	5	13	12	11	2	1.51	1.00		w.s.w.&n.w.
December,	28.38	53	0	53	1	14	3	17	11	4	8	1.05	8.75		w. s.&s.w.

Prevailing winds of the year, w. s. & s. w.—Number of fair days, 150; do. cloudy, do. 105; do. variable, do. 110; rain fell on 98 days; snow fell on 30 days; thunder and lightning occurred on 21 days; depth of rain, 22.39 inches, 3.47 inch. less than 1833; depth of snow, 29.62 inches, 40.25 inch. less than in 1833; hottest month, July; coldest month, December; greatest monthly range of thermometer in February, 65°; least do. do. do. June, 36°; the mercury was highest, July 9, 94°; do. lowest, Jan. 25, —4°; yearly range of thermometer, 98°; mean temperature of the year, 48.54°; do. of the spring months, 49.40°; do. summer do. 64.04°; do. autumn do. 48.27°; do. winter do. 30.17°.

The first frost, was on the night of the 29th Sept., two weeks later than in 1833; the last frost in the spring was the 14th and 15th of May, at which time snow fell four inches deep, a very uncommon

occurrence in this section of the coautry, where we rarely get snow over four inches deep, at any time in the winter. The months of Aug. and Sept. were uncommonly dry, and the corn crop was severely injured. In the fall months, remittent fevers prevailed throughout this part of the country, and on the whole, the season has been unfavorable and sickly.

4. *Ancient Mineralogy, or an inquiry respecting the mineral substances mentioned by the ancients—their uses, &c.;* by N. F. Moore, LL. D., Professor of Greek and Latin in Columbia College, New York; Carvills, 1834.—This little work, of one hundred eighty seven pages, 12mo. has two important characteristics—not always found united in literary works at the present day; there is little pretension, but there is much performance. It is obvious that the learned author, while as a philologist, he has diligently explored the rich fields of classical literature, has not forgotten to cull whatever of science and of art has come in his way. This small volume presents interesting materials, drawn from many sources, the result of extensive reading in ancient and modern authors, and of vigilant and discriminating observation applied not only to books, but to minerals themselves. The author may indeed be, as he modestly styles himself, "a learner" in mineralogy, but it is apparent that he is not one of those, who are ever learning, and not able to come to the knowledge of the truth. His elucidations of ancient mineralogy by comparison with the modern, evince his familiar acquaintance with both; and he has performed a difficult service, for which few men are qualified, because the eminent classical scholar, and the proficient in mineralogy, and the connected arts, both of ornament and utility, are rarely united in the same person. Dr. Moore's work will prove most acceptable, not only to teachers and readers, but to all enquirers on the subject upon which he writes, and we trust that the sale will render it necessary soon, to prepare a new, if not an enlarged edition.

5. *Elements of Chemistry, for the use of Schools and Academies;* by L. D. Gale, M. D. New York, 1835.—The author having been during the last seven years, engaged in public instruction in Chemistry, has experienced inconveniences from the want of an appropriate text-book for his pupils; and the present work, "illustrated by more than one hundred engravings," is designed to obviate these difficulties.

The form of the "Conversations" is generally considered as detracting from its merits and utility, and any attempt at improvement in books for elementary instruction is recommended by the previous familiarity and experience of the author, which in the present instance give the work claims to public notice.

6. *Lyceum of Natural History, New York.*—This Society, since our last notice of its proceedings, has been actively engaged in endeavors to extend its resources, and enlarge its prospects of future usefulness, which appear likely to result in speedy and gratifying success. The friends of science in New York have come forward to aid it, by subscription to shares of a stock, formed by the Society, which has already enabled them to purchase ground in a commanding and desirable spot, where, when the subscription is completed, a building adequate to all the purposes of the Lyceum will be erected; in which their valuable and rapidly increasing Museum can be efficiently displayed; courses of lectures on scientific subjects delivered; and where the students, and friends of natural science, may find a rendezvous not unworthy of this great metropolis. The following are some extracts from their minutes.

July 14, 1834.—A specimen of the new mineral, named by Dr. Thomson of Glasgow, Bytownite, from Bytown, U. C. where it is found, was presented (together with some books,) by Dr. Holmes of Montreal.

Sept. 15.—Dr. Metcalf read a paper, entitled "On molecular affinities," in which he attributed all attractions and repulsions of matter, all chemical and electrical affinities, and all motion, to the operation of caloric alone.

Dr. Harlan communicated information received from Dr. Troost, of the discovery of the remains of the Megalonyx in a cave in Tennessee, called Big-bone Cave. Dr. H. further remarked, that the bones of the Megalonyx, which he himself had formerly described, as having been found in White Cave, Kentucky, he has since ascertained to have come from Big-bone Cave in Tennessee. Through the liberality of these gentlemen, the Lyceum has received casts of all these bones, which are now displayed in their cabinet.

Mr. D. J. Browne presented a number of shells, principally from Teneriffe, among which were several rare species.

Sept. 22.—Mr. Whelpley, of Cleaveland, Ohio, announced the formation of a Society of Natural History at that place, for which he requested donations of minerals.

The new chemical elementary substance, named Kreosote, remarkable for its antiseptic and solvent properties, was presented to the Lyceum by Dr. Feuchtwanger, who explained its origin and qualities.

Sept. 29.—Some very large and beautiful specimens (principally crystallized) of carbonate of lime, quartz, pearl-spar, amethyst, &c. and lava, from different parts of Mexico, were presented by Mr. J. Ehlers of Zacatecas.

Oct. 20.—Mr. Cooper presented a collection of the eggs of birds, breeding in this vicinity, with the nests of such as build nests. Also eggs of various species of Tortoises; also a collection of Echinidæ, sixty five in number, comprising many different Genera and species, two of which he obtained in the waters of New York; also an extensive series of corallines, asteriæ, and comatulæ, from various countries, mostly named; also a collection of various shells, and other marine productions, fossils, &c.; and eighteen jars and bottles containing various quadrupeds and reptiles from this vicinity, preserved in spirits.

Dr. Jay presented a large fossil Pyrula from Florida, and several beautiful Echini, among which are two specimens of the singular Echinus atratus from Sumatra.

Dr. Swift presented ripe capsules of Sesasum orientale, the Benne plant; the seeds were sown early in June, and the plants destroyed by frost on the night of Sept. 29th.

J. W. Cooper deposited with the Lyceum a collection of about one hundred species of rare birds of our vicinity, well prepared and preserved in seven cases.

Oct. 27.—The President laid before the Society, an order from the widow of the late Col. Gibbs, for the large mass of meteoric iron deposited with the Lyceum, by that gentleman about fourteen years ago, which was accordingly ordered to be given up to Mr. C. U. Shepard.

Nov. 10.—Mr. Cooper offered a specimen of Pecten concentricus, from our waters, to which were adhering various individuals of Anomia Ephippium, Crepidula convexa and plana, all of which, from this circumstance had acquired the ribbed surface and scalloped edge of the Pecten. Such shells becoming detached, have given rise to the establishment of supposed new species.

The President, having announced the decease of the distinguished Naturalist, Thos. Say; it was *Resolved*, That the Members of the

Lyceum of Natural History of New York, have learned with deep regret the death of their distinguished Associate Thomas Say, and as cultivators of natural science, respectfully unite in offering this tribute to his memory.

Dec. 8.—Fine specimens of Iceland spar were exhibited, by Dr. Torrey, possessing a perfect trebly-refracting power.

Dec. 15.—Dr. Barratt read a monograph on the Genus Salix, in which with many useful remarks on the habits and organization of the genus, he has described about one hundred species of indigenous willows, with numerous varieties. He also furnished a conspectus of the North American willows arranged in nine sections, and a tabular arrangement of forty four species growing in the vicinity of Middletown, Conn.—This monograph illustrated by plates, will appear in the Annals of the Lyceum, of which a volume is now in the press.

Dr. Asa Gray of Utica, N. Y. contributed a monograph on the N. Amer. species of the Genus Rhyncospora, in which he has arranged and described thirty species, fifteen of which are new and previously unrecorded. Dr. Gray also furnished a notice of some new and rare plants, natives of the State of New York, in which he has described and characterized forty two species of remarkable indigenous plants. These papers will likewise appear in the Annals.

Dec. 22.—Specimens of Viscum verticillatum in fruit, were laid on the table, from its most northern observed stations in N. J. Dr. Barratt informed the Lyceum that he had met with a specimen of Viscum in the Western States, which he had no doubt would prove on examination, a distinct and undescribed species.

Dr. Barratt exhibited dry specimens of Amanita muscaria, and var. regalis (Fries) of the same, with drawings of the plant in its growing state, and related the singular use of this Fungus in Kamtschatka and parts of Russia, where it is prized for its inebriating qualities.

There were received, during the last two quarters of the year 1834, the following books.

From Societies.

The Zoological Society of London, Vol. I, Part 1 of its Transactions.

The American Philosophical Society, Vol. IV, Part 3, No. 1 of its Transactions.

The Geological Society of Pennsylvania, Vol. I, Part 1 of its Transactions.

The Academy of Natural Sciences, Philadelphia, Vol. VII, Part 1 of its Journal.

The Boston Natural History Society, Vol. I, Part 1 of their Transactions.

From Authors.

Mr. Isaac Lea, his "Memoirs of Unio and other genera of fresh water shells," with numerous plates.

Dr. S. G. Morton, "Synopsis of Organic Remains of the cretaceous group of the United States," with plates of Fossils.

Prof. Breithaupt of Freyberg, "Complete characteristics of Minerals," &c. &c.

And the following additions to the Cabinet not previously mentioned: viz.

From Dr. Holbrook, two specimens of Testudo from Carolina.

From Mr. L. Thomas, Coral from Seas of Java.

From Dr. Boyd, various Crustacea, shells, and mineral and geological specimens.

From Dr. Harlan, portrait of Cuvier, and other engravings.

From Mr. Winslow, ores of iron from New Jersey.

From Dr. J. W. Powers, minerals.

From Dr. Feuchtwanger, a very large Fasciolaria and other shells.

From Mr. C. Cramer, numerous minerals and geological specimens.

From Dr. D. Hosack, eighty seven geological specimens.

From Dr. Barratt, Mr. Thompson, Mr. Browne, shells from the rivers of this and the neighboring states.

From Col. Clarke by Dr. Swift, a remarkable mass of imbedded fossils from Saugerties, N. Y.

7. *Observations on the Solar Eclipse of November 30th*, 1834. —Observations made at Nantucket, Mass. in lat. 41° 16′ 32″ north, and long. 70° 7′ 42″ west of Greenwich, by William Mitchell.

	h.	m.	s.	
Beginning,	1	29	13	Mean solar time at Nantucket.
End,	4	0	43.6	
Duration,	2	31	30.6	

Magnifying power of telescope, 50. Depression of thermometer exposed to the sun, 19°.

Observations made at Huntington, Long Island, in Lat. 40° 48′ 47⅛″ N. and Long. 4h. 53m. 52.7s. West of Greenwich, by Frederic R. Hassler.

	h.	m.	s.	
Beginning,	1	9	53.44	Mean time.
End,	3	45	18.55	
Duration,	2	35	25.11	

Observations made at Milledgeville, Ga. in Lat. 33° 7′ N. and Long. (nearly) 83° 20′ West of Greenwich, by M. Nicollet of Paris.

	h.	m.	s.	
Beginning of Eclipse,	0	15	28	Mean time at the State House.
Beginning of total darkness,	1	42	53	
End of total darkness,	1	44	8	
End of Eclipse,	3	5	42	
Duration of total darkness,		1	15	
Duration of the whole Eclipse,	2	50	14	

8. *Recherches sur les Poissons Fossiles, par L'Agassiz—Great work of Prof. Agassiz on Fossil Fishes.*—We have had (through the kindness of the author, and of Mr. Mantell,) the pleasure of examining the two first livraisons of this splendid work. They are in large quarto, and contain nearly one hundred pages each. The plates are in large folio, and forty seven were sent with the two first livraisons; they are well executed by lithography, and colored so as truly to represent the originals; and we suppose that they are, in general, intended to be as large as nature. M. Agassiz states in his preface that he has already ascertained that there are more than five hundred species* of extinct fishes; and he thinks that when the subject shall have been fully examined, the number will be augmented to one thousand. He has examined more than ten thousand individ-

* In a letter this day received, (Feb. 22, 1835,) from Prof. Agassiz, dated Neufchatel, Switzerland, Jan. 6, 1835, he states the number of extinct species already ascertained, as being eight hundred. He manifests the most lively interest to become acquainted with American localities of ichthyolites, and to receive specimens and descriptions of them; he has carefully noted all those published in this Journal, and in other works from this country which he has seen. We earnestly solicit for him, the assistance of American Geologists.

ual fossil fishes, and he gives an interesting account of the great number of collections and of localities in Europe, not omitting those hitherto published as existing in this country.

He found most of the ichthyolites in the European Museums in great confusion—few of the specimens labelled, and most of those, only provisionally, except as to locality. He considers his work as being, in regard to vertebral animals, the sequel and conclusion of Cuvier's great work Sur les Ossemens Fossiles.

The work will be in twelve livraisons, at twenty four francs each; making five Volumes quarto for the text, with two hundred and fifty plates in folio. After the third livraison the price will be enhanced to thirty six francs for each livraison. This vast work is undertaken at the private expense of Professor Agassiz, who as we understand from a foreign friend, "is a highly intelligent, unassuming, liberal man,"* who depends upon the scientific world to sustain him in his arduous and costly enterprize.

We confidently recommend the work to our colleges and other institutions, as well as to individuals whose means are not limited. It is an honor to the science of the age, and will give celebrity to Prof. Agassiz, and to Neufchatel in Switzerland, the place of his residence and of his publication. It is presumed that it may be obtained through any bookseller in London or Paris, and through their correspondents in this country.

Prof. Agassiz invites subscriptions to be addressed directly to himself.

9. *Visit of Prof. Agassiz to Mr. Mantell's Museum at Brighton.*

Remark by the Editor.—In Vol. XXIII, p. 162, we gave a notice of the very interesting and in many respects, unique museum of Mr. Mantell, late of Lewes, now of Brighton, England. We now add another notice from the pen of Mr. Bakewell;† it is signalized by the visit of several eminent men including Prof. Agassiz of Neufchatel, of whose great work on fossil fishes we insert a notice.

Last week, Professor Agassiz visited the Museum of Mr. Gideon Mantell, at Brighton, purposely to examine the splendid collection

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* In the abstract of the doings of the great Scientific meeting at Edinburgh, Sept. 8, 1834, it will be seen that this gentleman was present, and took a conspicuous part in all questions relating to fossil ichthyology.

† London Athenæum of Nov. 15, 1834.

of Fossil Fishes, discovered by that gentleman in the chalk hills of the South Downs. A distinguished scientific friend had the gratification of being present, and thus writes to us :—

"M. Agassiz expressed his extreme delight and astonishment at seeing the internal structure of many of the fishes so fully displayed. 'In other collections (he said,) in various parts of Europe, I have seen the external forms of fossil fishes in high preservation; but I never expected to see the interior organization and structure laid open in the distinct manner which has here been effected by the consummate anatomical skill of Mr. Mantell. No museum I have hitherto examined, presents any thing of the kind comparable to the collection now before me.' The great attention M. Agassiz has bestowed on this department of natural history enabled him to throw much light on some of the specimens. He confirmed, in general, the conclusions of Mr. Mantell, particularly with respect to that remarkable elongated, cylindrical mass, seen within the bodies of some of the fossil fishes, which, in the earlier specimens, Mr. Mantell supposed to be the air-bladder, but which he had recently informed me, he believed to be the stomach or colon. One of the specimens of fish resembles the Amia of Carolina; and M. Agassiz has lately dissected a specimen of a fish, sent from the United States, which presents a great analogy to the fossil fish, and has corroborated the opinion, that the internal mass was the stomach. M. Agassiz further confirmed the character given by Mr. Mantell (in his valuable work on the 'Geology of the South east of England,') of several of the Ichthyolites in his museum, as belonging to the families of Salmo and Zeus, or Dory, of which, according to M. Agassiz, there are several extinct species in Mr. Mantell's museum. The jaw and teeth of an animal resembling, in some respects, the jaw of a crocodile, but differing in other particulars (see 'Geology of the South-east of England,' p. 153,) M. Agassiz says, belongs to an extinct class of animals, which he calls Sauroid Fishes, or fishes which had a structure approaching that of Saurians or Lizards.

"For the information of your readers who have not seen Mr. Mantell's museum, it may be proper to state, that the fossil fish in this collection, unlike those generaly discovered in the strata below or above the chalk, preserve their natural rotundity of form. In some specimens, the mouth is open, as if in the act of swallowing, and where the internal structure is exposed, the stomach is round and uncompressed. This fact is of considerable importance, as it proves

that the animal perished by some sudden evolution of mineral matter, which encased the body before the putrefactive process had commenced, and enabled it to resist the pressure of many hundred feet of chalk deposited over it. Besides the collection of fossil fishes, there is also, we believe, a more complete collection of Fossil Zoophytes and Shells, from the chalk, than can be seen in any other museum; but its chief glory consists in the remains of enormous reptiles, discovered by Mr. Mantell in the Wealds of Sussex, to which he has recently made many important additions, since the removal of the museum from Lewes. To Mr. Mantell we are entirely indebted for our knowledge of the Iguanodon, a terrestrial reptile, approaching closely in form to the Iguana of the West Indies, but from 70 to 100 feet in length. One thigh bone is three feet eight inches in length, and about thirty four inches in circumference at the condyles: a group of four vertebræ of the tail, each of which is nearly twenty-four inches in circumference, prove the gigantic size of the animal. Through the kindness of some of his scientific friends in Brighton, Mr. Mantell has obtained possession of the skeleton of this animal, found the last summer at Maidstone, which is now in his museum; and though several of the bones are mutilated or lost, it has enabled Mr. Mantell to make out the osteology of some parts of this extraordinary animal which were before obscure. The toe-bones are, some of them very large, and closely resemble those of the hippopotamus: these Mr. Mantell believes to be metatarsal, belonging to the hind feet, while the bones of the fore feet, or fingers, are comparatively slender, like those of the recent Iguana; a supposition rendered probable, when we reflect that the latter reptile climbed trees, and therefore required prehensile feet; but the monstrous Iguanodon would in vain have sought for a tree on which to suspend his colossal form, and would want a firm support for his enormous carcase. The claw-bones which Mr. Mantell has recently discovered, tend to confirm this conjecture: they resemble in form those of the land-tortoise. From the size of the thigh-bone before mentioned, we may infer that the thigh itself, when clothed with muscles and integuments, and covered with scales, must have been as big as the body of a large ox. Though numerous teeth of the Iguanodon have been discovered, it is greatly to be regretted that no head or jawbone has yet been found; but the recent discovery of so large a portion of the skeleton, in one mass, as that from Maidstone, has fully confirmed Mr. Mantell's inferences from the detached and broken bones found before in Tilgate Forest.

"A large portion of another skeleton of a different reptile, which Mr. Mantell calls the Hylæosaurus or forest Lizard, presents some remarkable characters,—particularly a row of terrific spines, 17 inches long which were probably erect on the back, and in this respect realized the forms of the fabled dragons of romance.

"M. Agassiz spent four days chiefly in examining the fossil fishes; and he regretted that his engagements as Professor in a foreign university compelled him to return so soon. During his visit, I had several times the pleasure of meeting M. Agassiz and Mr. Mantell in the museum, with Dr. Buckland, Dr. Faraday, Mr. Lyell, and Mr. Ricardo.—B."

10. *Specimens from Mr. Mantell.*—We have often been indebted to the liberality of this distinguished friend and eminently successful cultivator of science, for interesting specimens from the truly classical geological region in which he resides; among many recently received are the following.

Marsupites Milleri: two very fine specimens: the chalk being more completely removed with a penknife, the structure will be still more evident.

A cast of the inferior or condyloid extremity of one of the largest femurs of the Iguanodon in Mr. Mantell's Museum: from Tilgate forest. Its lower extremity is thirty four inches in circumference; it is like a stick of timber.

Casts of three claws or unguical bones of reptiles, viz. claw bone of the hind foot, claw bone of the fore foot of the Iguanodon; the former were hooked or curved, like those of the Iguana, the latter compressed like those of the land turtle. Claw bone of a Crocodile.

A very fine portion of a young Elephant's tooth, from Brighton Cliffs—very rare.

A good series of characteristic shells of the Brognor rocks, (Hampshire tertiary basin—vide G. S. E. of England,) Western Sussex.

Fossils from Stonesfield: these in addition to the specimens formerly sent, will form a good suite of the organic remains of these extraordinary deposits.

Ribs of Iguanodon. The portions of ribs in sandstone from Tilgate Forest will serve to convey an idea of the usual appearance of the specimens in Mr. Mantell's collection that were imbedded in sandstone, and are very distinct and perfect.

Fishes from the chalk. There are several fine specimens of the Zeus Lewesiensis, which M. Agassiz has named *Beryx ornatus*; some of them shewing the vertebræ, bones of the head, &c.

There are two or three specimens of the ancient shingle bed from Brighton Cliffs; pebbles held together by calcareous spar, which is white and beautifully crystallized among the pebbles.

Nummulite rock from the great Pyramid of Egypt: the foundation of this wonderful structure rests upon the nummulite limestone, and the Pyramid is in part composed of it. This specimen was collected by a friend of Mr. Mantell, Dr. Hall, who was travelling, fellow of the University of Oxford. With a lens, the curious structure of the shells is very beautifully shown. Herodotus alludes to these curious bodies and says they are the lentils thrown away by the workmen, which have become changed into stone. The late Dr. Edward Clarke, (the traveller) was the first who noticed this rock in the Pyramid and pointed out the allusion of Herodotus.

Vertebral bone near the end of the tail of the Iguanodon, is four inches long and nearly four thick in the largest place.

11. *Apparent loss of weight in the human body under certain circumstances.*—We insert this letter, as it relates to the subject of one of the articles in the late number of this Journal. It is desirable that it should be decided either that the appearance is illusory, or that a reasonable cause should be assigned.—*Ed.*

Kingston, Upper Canada, Oct. 31, 1834.

To the Editor,—*Sir*,—As a subscriber to your valuable Journal, I take the liberty of asking of some of your scientific readers the rationale of the following experiment.

An individual is to place himself on a stool or table on his back; with his arms and legs crossed, keeping the whole body stiff; four or six others are then to place themselves at about equal distances, by the sides of the first—say two at the shoulders—two about the middle of the body, and the others by the hips and thighs. Extending the forefingers of each hand so as to touch the body, somewhat underneath. At a given signal the whole party are to take as full an inspiration as possible, and at another given signal, simultaneously to respire very slowly, gently pressing the body upwards at the same time, when it will be found to rise with a very slight effort, and to continue rising until the breath is exhausted, when it will suddenly fall down with great force. The operators must be prepared for this

circumstance, and immediately pass their arms under the body to break its fall; it will also be well for one individual to hold a pillow under the head, for the same purpose. The experiment appears to succeed best in a closed room, and if the inspirations and respirations are not uniform, it will fail. I first saw it tried about twenty years ago, but have never yet heard or seen any satisfactory explanation of it.

I am not aware that it involves any principle adverse to the known laws of gravitation, but it certainly appears for a short time to act independently of them. If you deem it (this letter) worthy of a passing notice, I should be glad to see it—if otherwise, let it be deposited in the Archives of the College of Laputa.

I am Sir,—Respectfully yours

JAMES NICKALLS, JR.

12. *Vesuvius and Etna.*—It appears from Galignani's Messenger that there was a tremendous eruption of Vesuvius, towards the close of last August.

Upwards of fifteen hundred houses, palaces, and other buildings, and twenty five hundred acres of cultivated land have been destroyed by the fires. The eruption, which, from the drying up of the fountains, has been previously expected, surpassed every thing which history has transmitted to us. The first explosion destroyed the great cone situated on the top of the mountain. The abundance of the inflamed matter produced flashes which darted through the mountain's flank. A new crater burst open at the top of the great cone, and inundated the plain with torrents of lava. The king and the ministers hastened to the seat of the catastrophe to console the unfortunate victims. The village of St. Felix, where they first took repose had already been abandoned. The lava soon poured down upon this place, and in the course of an hour, houses, palaces, and churches, were all destroyed. Four villages, some detached houses, country villages, beautiful groves and gardens, which, a few minutes before, presented a magnificent spectacle, now resembled a sea of fire. On the 3rd of September, nothing but stones and cinders were ejected, and every prospect existed of the eruption being soon at a close. The palace of the prince of Attayanua, and five hundred acres of his lands are utterly destroyed. The cinders fell, during an entire night over Naples, and if the lava had taken that direction, there would have been an end to that city."—*N. Y. Obs. Nov.* 28, 1834.

By a letter from Sig. Murio Gemellaro to the Editor, dated, Nicolosi upon Etna, March 24, 1834, it appears that "Etna continued silent."

13. *A new Observatory at St. Petersburgh.*—An observatory, far surpassing in magnitude every similar establishment, is about to be built at St. Petersburgh, by command of the Emperor. The observatory itself will consist of three towers with moveable cupolas. Two of these towers are to be appropriated to the Konigsberg heliometer, and the Dorpat refractor; but the center tower is destined for the reception of an instrument exceeding in size all others of the kind. In the lower part of the towers, the meridian and transportable instruments will be placed. Spacious habitations for five astronomers will be connected by two corridors with these towers; so that the whole will form a continuous building, five hundred and ten feet in length. Smaller subordinate buildings for various purposes, will increase the establishment, for the site of which, an eminence, between six and seven miles from St. Petersburgh, has been selected.—*Atheneum, Sept.* 1834.

Information requested respecting the variation of the Magnetic Needle.—It is a matter of very considerable importance to the cause of science, that the variation of the magnetic needle in every part of the globe should be accurately known. The labors of Halley, Yates, Hansteen and Barlow have added much to our knowledge on this subject; but it must have been observed by every one who has examined their charts, that the lines of equal variation through this country are laid down with little attention to minute accuracy. Indeed it is believed that sufficient observations have never been published to furnish the materials for a complete magnetic chart of the United States. An effort is now making to supply this deficiency; and it is urgently requested of Surveyors, of Philosophers, and all in this country who are interested in the subject of magnetism, to communicate for this Journal any observations they have made for determining the present variation of the needle at their respective places. Any observations made in former years at the same places, will also be valuable for determining whether the variation is increasing or diminishing, and at what rate.

THE AMERICAN JOURNAL OF SCIENCE, &c.

ART. I.—*Remarks on the Idolatry and Philosophy of the Zabians*; by JOHN W. DRAPER, of Christiansville, Mecklenburg Co., Va.

THERE are several questions of chronological and philosophical importance, which would receive much light from a thorough development of the religion and philosophy of some eastern nations. Any one who is acquainted with Asiatic literature, cannot have failed to observe, that although a claim to extravagant antiquity cannot fairly be supported, yet we may safely allow to many others, as well as to the Chaldee priests, considerable acquaintance with science. To deduce some of their philosophical opinions, from such fragments as remain of their idolatry and religion, is the object of this paper.

From the discourses of Sir W. Jones, the united testimony of the ancients, and from recent writings of oriental scholars, we may safely conclude, that the Iranians were the first idolaters of Asia, who forgetting the pure religion of their forefathers, indulged in the mythic reveries of astronomy, and joined them to the simple maxims of life. The Alexandrine Chronicle states, that Ninus first taught the Assyrians idolatrous worship.* The name under which these first apostates went, was Tsabians, Zabians, or Sabeans.† The Zabians were the first corruptors of the true religion, and long before the time when the Jewish historians placed the birth of their ancestor Abraham, the Chaldeans had multiplied the invisible Deity, into Lords many, and Gods many.‡ That Zabianism was the first spe-

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* Chron. Alex. p. 64.

† Prideaux Conn. Vol. I. p. 178. Maimonides Moreh Nevochim.

‡ Shuckford's Conn. Vol. I. Ch. 5.

cies of idolatry, besides the many allusions to it in Scripture,* we have the evidence of the most ancient pagan historians, of whose writings any part has reached us. Herodotus speaking of the religion of the Persians, says, They worship the sun, moon, earth, fire, water, and the winds; and this adoration they have all along paid. Diodorus Siculus says, the early men supposed the sun and moon to be the principal and eternal gods. And Sanchoniathon informs us, in the fragment preserved by Eusebius, that the two first mortals inhabited Phenicia, and when they were scorched by the heat, they lifted up their hands to the sun, whom they supposed to be the Lord of heaven, and called him Baalsamen,—him whom the Greeks call Zeus.

The Zabians lived on the north east of that part of Arabia, which, by the common consent of mankind, had been denominated '*The Happy*," on a neck of land, plentifully enriched by the dews from the Arabian and Caspian seas, and supplied with rivers from the mountains of Taurus, which run through its whole length. In these pleasant regions, the earth does not require that toil, to bring her fruits to perfection, which other countries demand. The wants of man are plentifully supplied by the profusion of nature, and even the luxuries of life are bounteously furnished. Sweet smelling gums drop from the trees, and whatever can please the eye or enchant the ear, is met at every step, in these delightful lands,—not unaptly deemed the seat of Eden and of Paradise.

Here nature was free to form the minds of men; there was nothing which asked their labor. A life without care is not unfitted for *philosophic* contemplations. Hence, to the present day, the natives of these climes are known, as a peaceful race. It is interesting to observe how the strains of their poetry sometimes pass from personal feeling to philosophy, and this, as a natural effect of the conformation of their minds, is influenced by scenes passing around them. A beautiful instance of this may be seen, in one of the songs of Fani, where he bewails the departure of Venada. "The ship which bore her from these lands was freighted with my last happiness. I have never had a care to enquire, if she arrived safe, in the sunny climes whither she sailed; for it gives me a melancholy delight, to walk by

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* ὅτι οὐκ ἐβουλήθησαν ἀκολουθῆσαι τοῖς θεοῖς τῶν πατέρων αὐτῶν, οἳ ἐγένοντο ἐν γῇ Χαλδαίων, **Judith, ch. 5. v. 7.**

the waters of the Ocean, and think that perhaps that may be her resting place. Or, I can look upon the setting sun, and hope that she too beholds him in his evening glory. I feel freshened by the breeze, for it may have passed gently over her, while training her tender flowers, or perhaps bear with it the echoes of her guitar, which she played at the shut of day, in her father's orange grove. Life, has not unappropriately been called the 'Vale of tears,' for its passage is bitter; how the transit through the gate of death to the tomb may be, I cannot tell. But when I have been falling asleep, the tones of distant evening music have been very sweet, and the workings of a calm imagination delightful. I would then hope, that when the ties between the body and the mind break one by one, when earthly objects fade away, and the hum of this distracted world grows faint and more faint, that there is a serene prospect in the soul of fairy landscapes and happy climes, surpassing the lovely calmness of these Indian skies, or the pleasant vales in the Fortunate Islands."

A clear firmament furnished the Chaldeans with a school for astronomy,—and they were sensible of the advantages of their situation. Berosus* states, that the Babylonians possessed astronomical observations made four hundred and eighty years before his times and Epigenes, that they reached to seven hundred and twenty years before him, or to the reign of Nabonassar. When the sword of Alexander had destroyed the Persian Empire, Callisthenes found among the ruins of Babylon, astronomical observations taking in a series of 1903 years,† and Diodorus Siculus‡ reports, that when Alexander was in Asia, the Chaldeans reckoned 473000 years, since they first observed the stars;§ not that so long a space was understood by themselves of years, unless they joined in the common boast of oriental nations, in proclaiming a feigned antiquity. For it is probable, that these years were but periods or cycles of short length, which when they were properly arranged by Callisthenes, amounted to no more than 2000 solar years. These reports of the early efforts of the Chaldeans, are corroborated by the testimony of many eastern writers.‖ Mohsani Fani in his account of them, confirms in some degree the fragments of Berosus, observing that they assidu-

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* In a fragment preserved by Pliny, L. 7. ch. 66.
† Simplicius de Cœlo, L. 2. Com. 46. p. 123. b. 18.
‡ L. 2. p. 83. § Sir I. Newton's Chron. p. 265. ‖ Jones's Discourse 6th.

ously regarded the heavens, adoring the stars, and had made such successful progress in science, as even to discover a number of artificial cycles, which seem to indicate their knowledge of the precession of the equinoxes, an occurrence, which from its very nature, must have been discovered by long observation, involving a knowledge of the nicer mechanic arts, and were its theory found out, a perfect acquaintance with the attractive* power of the sun, of Kepler's law of the squares, of the spheroidal figure of the globe, and perhaps some general idea of the nutation of the earth's axis.†

That desire of propagating what is more than the truth, which unfortunately is so prevalent among our contemporaries, was freely indulged in those early ages. Plutarch says, that most of the Egyptian fables, are mere allegories of natural operations; Dionysius of Halicarnassus and Prochus, that all the Greek fables, were physical circumstances, clothed in romance.‡ Philo Biblius thought, that the Egyptian Thoth, wrote his sacred books in a mystic manner, in order to create reverence and respect, or upon the principle, that Eusebius§ elsewhere mentions, because the ignorant crowd were as incapable of understanding what was written, as what was suppressed. By the fragments of Sanchoniathon of Berytus, and Berosus the Chaldean, we see that this was their style, and from the circumstance mentioned by Eusebius, that the former had much trouble when compiling his history, to select truth from allegory, we learn that writers more ancient than himself, invented accounts and mysterious fictions, drawn from their ideas of different circumstances. Personification, is a figure which we are naturally prone to use. We cannot then wonder, why these early philosophers who looked upon the stars, and saw them so bright, who observed their regular motion, their number and their distances, and who reasoned upon them as though they were eternal, should, at last, reason themselves into a pantheistic belief, of some spirit,‖ which nourished the life of being,—a soul, which diffused through the vast members of this universe, agitates the whole mass, and forms but one immense body.

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* See Lagrange's prize essay on the libration of the Moon, Newtoni Princ. Phil. Nat. or in the absence of an acquaintance with the integral and differential calculus, Frisius in Cosmographia.

† Principio Assyrii trajectiones motusque stellarum observaverunt.—Chaldei diuturna observatione siderum scientiam putantur efficisse. Cicero de divinatione, L. 1, c. 1.

‡ Euseb. præp. evang., L. 1, c. 10.

§ Præp. E. L. 1, c. 9.

‖ Virg. En. 6, v. 727.

There are certain eternal truths, which men, by the unassisted power of their own minds, are always able to discover. Among these, the existence of a Maker of this beautiful universe, stands preeminent. The Zabians recognised One Supreme God, in the character of a demiourgos, or soul of the world. Accustomed to judge of the laws of nature, from the impotent institutes of man, they did not perceive, that whilst these were liable to infraction,—those could not in their very nature be broken. The 'Thou shalt not destroy it,' which is stamped on every atom of matter, is a law which no human art or knowledge can ever break. The Zabians had early discovered, the unchangeability of matter, and making its eternity a grand principle of their creed,—they endued it with a thinking power, and as they could imagine no place where matter and mind did not exist, they filled infinity with the thinking part, and called it God.* Him, in common with many eastern nations, they never mentioned; holding him too sacred and too great for human lips to pronounce, but certain mystic letters indicated his name, the true pronunciation of which, like the tetragrammaton of the Jews, was unknown.

This idea of a soul of the world pervaded the vulgar mythology of the Greeks and Romans, as well as the speculations of Plato and the philosophers. Ζευς of Greece, is said by Orpheus, in one of his hymns thus translated into Latin,

> Jupiter omnipotens is primus et ultimus idem,
> Jupiter est caput et medium—Jovis omnia munus,
> Jupiter est fundamentum humi ac stellantis Olympi,
> Jupiter et mas est et nescia fœmina mortis,
> Spiritus a cunctis validi vis Jupiter ignis.

It is but by supposing Jupiter to be a demiourgos, that the different accounts left by the ancients can be reconciled. Sophocles in Trachinus says, Jupiter Olympus is a parent of all things, Aratus points out in very plain language his idea of Zeus, and how are we to reconcile Horace, who calls Jupiter the air, Euripides, who calls him the moving force of the winds, Homer, who in many places marks him as the vital warmth, Lucretius, who calls him Æther,

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* Prideaux Conn. Vol. I, p. 177. Moreh Nevochim, "In the times of the Zabians, the utmost to which philosophers carried their speculations was to esteem God to be the spirit of the sphere or celestial orb. Supposing the celestial orbs and planets to be bodies and the supreme being the soul or spirit of them. Abubekr Alsaig Com. Arist. de auditu, Moreh Nevochim, ch. 4, Abulfeda Sharistani Relig vet. Pers. c. 22.

Virgil, who in different parts of his poem, gives him different characters, and Plato, who says, Jupiter, Pluto and Dionysius, all mean the Sun.

Once having admitted the existence of a soul of the world, the Zabians would have been involved in much difficulty, with regard to his moral government. In these early ages, the value of a human action perhaps was not determined, by its addition to, or subtraction from the general universal mass of happiness, but from a superficial view of its bearing, on the narrow circle of humanity. Under these circumstances, whilst the existence of Good was allowed, that of Evil must have been admitted, *and to account for this, under the dominion of a wise creator, gave birth in my opinion, to the religion of the Zabians.*

By likening unseen things, to those which are always present in common life, we obtain permanent pictures of what otherwise would be transient images. Fable and personification are but vivid forms of expression, whose value may be observed, by the distinctness with which they paint dim objects in striking colors, and the effect they produce. A species of worship which originated among men whose fancy was warm, could not long exist without the auxiliary advantages derived from figures of this class, and especially when it was necessary that abstruse subjects should be presented to the vulgar, in attractive shapes, readily understood. For it was a remark supported by long observation, and the lapse of many years, that idolatry requires to be cast into a popular form, and a false religion to be successful among men, must furnish them with some substantial form, some point of adoration, some emblem, or some visible shape, on which they may look, and to which they may pray.

The Zabian, who, either truly or falsely, had ascertained the existence of good and evil in mundane concerns, and was at a loss to account for the existence of both simultaneously, invented, perhaps the most ingenious allegory* which the wit of man has ever produced,—a piece of sophistry. As good is pleasant to the mind, by a slight transition from mental feelings to corporeal things, he called it Light, and taught that evil bears the same relation to it, that a shadow does to the effulgent point. Their allegory painted Ormusd as the good

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* Plutarch, Dion. Halicarnasseus, Proclus, Philo Biblius, Eusebius, and indeed all mythological writers mention personification as the very basis of idolatry.—Asiatic Researches, v. 3, p. 353. Asia. Res. v. 2, p. 303, and 482. Euseb. prep. evan. book 1. ch. 9 and 10, Shuckford, v. 1, p. 354, Plutarch de Iside et Osiride, p. 356.

god, or light;* Ahriman, the evil god, or darkness. Both these were supposed to be agents of the first cause, coequal,—their affinity to him was secondary, or subject, and between themselves they waged an everlasting war. The legendary tales and fables of the East teem with descriptions of their combats and prowess.

Bryant, in his Analysis of Ancient Mythology, shews that almost every deity of paganism was but a personification of the sun. Solar worship doubtless prevailed to a great extent. Sir W. Jones has observed, that although the gods of any given country, may almost invariably be found to be the same, or similar to those of any other, all *in general* being mere personifications of the sun, yet there are decidedly other, and many other sources, from which some of the best fables have been drawn; as Cupid and Psyche, Death, Disease. Time and other moral personifications, belong to the same class.

Before the Magian dissension from the established faith, it was held improper to adore either Ormusd or Ahriman. The first cause was only to be meditated on in silence, and worshipped under one mystic word, an ineffable name. And as to the adoration of Ormusd or Ahriman, since they were equal, and in one continued state of perpetual warfare, it would be doubtful that any prayer would be granted, as the opposite party to that to which the prayer was preferred, might chance to be the victor. But tradition derived from early years, and an idea natural to us all, that some being is to be worshiped, and a fear of provoking beings more powerful than ourselves, and a hope of receiving benefit from their assistance, all concurred in establishing the necessity of a third existence, a mediator between the great principles of Light and Darkness; one, who should save him from the hatred of either angel, and procure for him the kindness of both. The East point of the heavens, "whence the sweet influences of light first greet the world," was named, the abode of Ormusd;† the west,‡ the habitation of the black Ahriman. That intercessor and mediator who continually preserved a balance between the contending powers, who alternately visited, and for an equal time

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* Prid. Conn. v. 1. p. 179, Abulfeda Ebn Shabna Pocockii specim. hist. Arab, p. 147, Hyde relig. vet. Persa. cap. 9, p. 163. and cap. 22, p. 299.

† I put the more modern Persian names for the sake of convenience. It must not be supposed that these are the true names of the old gods.

‡ For this reason the Kebla of the Zabians was the meridian sun. The Magian Kebla was the rising sun. The Mohammedan is the temple of Mecca. The Hebrew was the house of the Lord. They turned their faces to the Kebla at the hour of prayer.

dwelt with either, was the Sun.* And hence arose the once universal worship of Mithras, the mediator, the savior, the sun.

Such appears to have been the *grand foundation* of the idolatry of the Chaldee priests. It appears to follow in such a simple train, and, if allowed, will explain such a vast number of facts connected with the idolatry of the ancients, for which otherwise, no appropriate reason can be given. I would advance these novel opinions with diffidence; it is however, interesting to observe, how well they account for the Magian dissention. The Zabians prayed to the meridian sun, the Magian to the rising sun; hence, as will be hereafter seen, there ought to have been on these principles, that dissimilarity in worship, sacrifices, &c., which actually existed.

The sun was not adored because of his beauty or glory, but because he was looked upon as a mediator, and this adoration gave an entire new turn to their religion, making it astronomical; for all the sun's powers, personifications, &c.† were to be worshipped; all astronomical occurrences, howsoever affecting his dominion, became at once objects of religious reverence; in fact the study of astronomy formed a part of the study of theology, and the influences supposed to be exerted by Mithras, the sun, over human affairs, invited by a very quick succession of steps, to the study of Telesms, and judicial astrology.‡

From man downwards to minerals, there is a successive series of created things. It was reasonable for these early philosophers to suppose, that from the First Cause and great angels, there might be a similar succession down to man. It was upon this consideration, that the doctrine of Fairies and Divs was invented; Ormusd had his hosts of angels or Peris, the Fallen one had his legions of Divs. The abode of the former was Shadcam, a place of pleasure and delight, whose walls were of pearls, and whose streets were paved with amber; gold and gems were in profusion in this enchanted place, and the happy fairy feasted on manna, and drank delicious nectar. They had likewise a resting place on earth, in some pleasant island of the Indian ocean, the enchanted castle and palace of amber abode might

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* Bryant Analysis. Sanson's Persia, p. 185. Relig. vet. Pers. C. 4. Asiat. Res. v. 1. p. 342. and v. 2. pp. 8, 58, and 400.

† Syphis Diod. Sic. L. 1. Shuckford v. 1, p. 345. Cic. Acad. Quæs, L. 3. c. 37. Cicero de natura deorum L. 1, c. 15.

‡ Shuckford v. 1. p. 347. Plutarch de defectu Oraculorum. Cic. de divinatione, Ch. 55. Landseer Sabean Researches. Maimonides Moreh Nerochim c. 12. Diss. 8. (Townley.)

be seen from the mountain of Câf, and a rosy cloud in the sky marked the position of the picture galleries of Arzhens. These happy abodes of the Peris, were appointed as the resting place for the good, the wise, and the great. Their mansions were built of diamonds and pearls, and the city is founded on a sapphire, the reflection of whose color tinges the sky. Around them are groves of oranges and limes, which are filled with the warbling of birds, and the murmur of brooks, at the close of day, "in the vale of Roses,

"All calmly hush'd the winds had ceased to roam,
"The trees scarce bent beneath their fond endeavour,
"The rolling rivers sought their ocean home,
"All silently for ever and for ever,
"Soft beamed the moon, and thro' the glade was heard,
"The weary warblings of the watchful bird.

"I passed through different groups unseen, by virtue of the ring that Perushan gave me in the woods of Kurdistaun; over every group happiness seemed to preside. I recognised the countenances of many ancient sages. The silver bells in the city rang happily, as they do on a bridal evening at Delhi, now their sound came full upon the ear, and then it was borne away by gales from the west. I saw those Houris who once lived in the garden of Eden, that are fed with manna by birds of Paradise, and drink water brought in purple shells from the sacred fountain of Mecca. I saw too, those angels who fell for the love of these, and who having suffered a sad punishment for centuries upon earth, were appointed to finish the term of their expiation in the city of Amberabad. They were led about in fetters of gold, and were by far, the most beautiful of the shadows I saw, except those lovely Houris, who were the cause of their sad transgression. I saw too, the road to Paradise; it was one splendid blaze of gems, and was arched over with delightful trees, to be a shelter from the heat of the sun. Exactly on the opposite side of the city was the gate of Death; it was an ancient structure of enormous strength, built of massive ebony, with a covered archway of the same. A solemn silence announced our approach to it. We crossed the river of tears, but advanced no nearer. Perushan said that under the archway was a mazy labyrinth, obscured by delusive shadows and a misty gloom."—(*Confessions of a Peri.*)

In the clear expanse of the unruffled fountain, whose surface beautifully reflected surrounding objects, it was supposed that the Divs resided; amid the inverted groves their palaces were supposed to be founded. Like their yielding habitation, their bodies were in

the wild imagination of the Zabian, easily divided, and yet as easily joined. Diminutive as to size, and yet possessing much more power than man, they gamboled in the watery recesses of the brook, or danced in mazy circles beneath the aged oak. Whilst the moon, with whom it was supposed that they held communion, drew nearer, to light with her beams, their midnight revels. In the eve of an autumn, the enfevered mind of the Zabian, heard the soft swell of their music, mingled with the songs of the nightingale, and the half audible sound of the distant cascade, as they, riding on the yellow leaf, and borne along by the nightfall breezes, chanted the praise of their superior master, and ruled in the midst of revelry, the destiny of man.

But the coolness of the refreshing river was not the only habitation given by the Zabian, to these scions of his heated fancy. Some were supposed to love the pinnacled height of the mountain, to delight in the mossy grot, or to riot in the forest; and as they stood next in the chain of creation to the evil principles, and were the connecting link between darkness and man, man naturally feared them. It was these beings who were inimical to all good, it was these daughters of darkness who wept, when the stars of the morning rejoiced, and all the sons of Ormusd shouted for joy.

The principles of the Zabian religion may be exhibited thus,

The First Cause.

Ormusd	Mithras	Ahriman
Light	who continually preserves a balance between the contending powers.	Darkness
Rising sun	Meridian sun	Setting sun
Too good to be adored	To be adored	Too evil to be adored
Former	Preserver	Changer

The various natural powers of the
Sun personified.
Astronomical occurrences, as day, night,
years, cycles, eclipses, comets, &c. &c. to be
held sacred.
The Lunar influence in dispelling Ahriman
celebrated in mysteries.
The astrologic influences of the sun and shining
bodies, whether stars or the element of
Fire.

On these principles the Chaldeans founded their religion, we now come to the practical part of it. For, when a few years had elapsed, the common people had entirely forgotten the existence of one First

Cause; they scarcely remembered Ormusd and Ahriman, adoring Mithras* the sun, in every possible shape and personification. The priesthood and philosophers were the depositories of what otherwise was out of recollection.

It has been said that the eastern sky represented Ormusd,—the western Ahriman, or in other words, the enlightened hemisphere represented the former,—the hemisphere of night the latter. Mithras, the sun, who continually appears in his great character of Mediator, by his rising dispelled the darkness, and was swallowed up in the night. This circumstance furnished a beautiful personification of those powers. Ormusd was painted fair and bright, Ahriman was black, and clothed in a sable mantle studded with stars.

That Pantheistic belief which was then prevalent, joined to the discovery of five erring stars, which revolved round the sun, and the supposed magical influence of the moon, all which were instinct with spirit, and rolled in their courses by angels, emanations from Mithras the invigorator, directed these idolaters to offer to each one a day,† and thus the week of seven days, of still more ancient institution, was parted out by the Zabians. The day consecrated to Mithras, was the Sabbath.

The Zodiac was divided into twelve signs, six summer, six winter. The six summer ones were of course the representatives of Ormusd, the winter ones of Ahriman, for Mithras voyaged alternately through them, and furnished personifications of the Great Angels. Ormusd like the Seraphim and sphynxes of Egypt, had a form shaped from the summer constellations; Ahriman such as might be formed out of Capricorn, Scorpio, and other dreary signs; cloven feet, horns, &c. When Mithras the intercessor entered Aries, he was denominated the Lamb of Ormusd, and so of his other personifications. His entrance upon these two distinct courses was celebrated *throughout the world* by grand festivals, one at the commencement of Spring, the other at the commencement of Autumn; of these, the May day festival actually still exists in those nations of Europe which are descendants of the Goths.

Every fixed and regular astronomical occurrence was thus personified or furnished personifications. It will hereafter be shewn

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* The Colossus of Rhodes was an image of the sun. The sacred rites of Osiris were commemorative of his half yearly course.

† Gibbon Decl. and Fall, v. 9, p. 244. Sale prelim. Disc. 14—24. Asiat. Res. v. 2, p. 59. Assemani Bib. Orient. b. 4, p. 580.

that eclipses, the return of comets, transits,* &c., were carefully noted, and furnished that mass of mythology, which so bewildered the Greeks and Romans.

It is remarkable that the Egyptians, in their drawings of Osiris and Typhon, painted the former of a yellow color, and held Typhon to have been red, the incipient color of the hemisphere of darkness. The Zabians, says Maimonides, (in Moreh Nevochim) offered sheep and oxen and other clean animals to Ormusd, but they sacrificed bats and owls, and other unseemly creatures loving darkness, to Ahriman. Those animals of the summer months, were held to be sacred, but those of the winter, unholy. The Chaldeans divided each sign of the zodiac into imaginary periods of one thousand years each, or the whole into twelve thousand years. They considered that the world had from the commencement, been under the astrological influence of Ahriman, but that when the six thousandth year should be complete, the government of the world would be given to Ormusd, as soon as he appeared as Aries the ram.

We now enter upon another part of the religion of the Zabians, which like the former is a mere offspring of human imagination. It is the natural history of Man, and firstly, it is one of those innate ideas, of which I have already spoken, which every one is conscious of, that he exists doubly, and consists of a material and immaterial body and soul. It followed from the Pantheistic faith of the Chaldeans, that there should be some pervader, some vivific instigator, in the body of man, perhaps they supposed his presence was more concentrated, than as it existed in things around. They however emphatically distinguished it from matter. They signified the common pervading essence by the import of SOUL, and that superabundance with which man was gifted beyond all other creatures by the import of MIND.

If tradition afforded them no light, perhaps it was on these grounds that they judged of the immortality of the soul. They knew that it was a law, stamped by the great Architect of all things, upon matter, that it was not subject to annihilation by man. The elements at which philosophers arrived, were unchangeable and indestructible. By combination they might put on fresh forms, and vary every moment in aspect, but whilst they are so liable to change, they are in-

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* It has been supposed that the Hindoo accounts of the incarnations of Vishnu Mahadeva are fabulous descriptions of the return of comets.

capable of annihilation. And, as they supposed the Universe consisted of matter and soul, they must have seen that each of these were eternal, and that it was very absurd to suppose that the nobler part should perish, and the ignoble remain.

It is necessary to make this distinction between the soul and the mind, before we can understand the mythology of any oriental nation; for the soul was the object of the great Pythagoric doctrine of transmigration, the mind that of absorption. The soul and body were held by the Zabians to be inseparable companions, *de facto*. The mind was held as a superfluity, engrafted upon them, supposed at some period to have been given, to have increased, and then to be taken away. The Zabians held, that at some unmentioned period of time, the First cause by a mere volition, created an atom which was pervaded by himself, and placed under such circumstances as would eventually result in the production of a human being. It was unknown through how many states it might have passed; the first in which it became cognizable to observation, was a mere lifeless inert mass, of a seminal nature; passing from that, it became a living creature of a fœtal form, then an infant, and after experiencing all the changes incident to human life, it fell to decay, it died: yet the principle of vitality which pervaded it, did not cease to exist, for passing through a variety of forms, it still lived even in the tomb, and passed into a state of animal or vegetable life. But the mind after the decay of the body, was in due time swallowed up in that ocean of Deity.

In the final destiny of the soul and mind, each change was painted by the Zabians with expressive forms, and not only the greater, but even all the lesser circumstances were personified. All the passions, the feelings, the workings of the heart, were penciled with much skill. Death, and sleep, and life, and birth, with all the supposed changes of past existence and future being, with all the possible occurrences which the mind could figure, were developed to the votary. Hence we may well conceive how those who were once initiated into these mysteries, like the sages who returned from the cave of Trophonius, never smiled again.

Strange as it may seem, these doctrines had at one time overspread the face of the earth. In a remote period of antiquity, Zabaism was diffused over Asia by the science of the Chaldeans, and the arms of the Assyrians.* Zabaism, or the worship of the host

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* Gibbon decl. and fall.

of heaven, overspread the world early and almost universally,* a resemblanee between the popular worship of the old Greeks and Italians, and that of the Hindoos. Nor can there be room to doubt of a great similarity between their strange religions, and that of Egypt, China, Persia, Phrygia, Phenicia, and Syria, to which perhaps we may safely add some of the southern kingdoms, and even islands of America. While the Gothic system which prevailed in the northern regions of Europe, was not merely similar to those of Greece and Italy, but almost the same in another dress, with an embroidery of images apparently Asiatic. From all this if it be satisfactorily proved, we may infer a general union or affinity between the most celebrated inhabitants of the primitive world, at a time when they deviated, as they did too early deviate, from the rational adoration of the only true God.† From the Chaldeans it spread all over the east, where the professors of it had the name of Zabians, from thence into Egypt, and from thence to the Grecians, who propagated it to all the western countries of the world.‡ The Zabians are a sect whose heresy has overspread almost all mankind.§ For the Babylonians were all Zabians, and indeed were the first founders of that sect. They first brought in the worship of the planets, and afterwards that of images, and from thence it was propagated into all other nations where it obtained, as hath been already shewn.‖ Hamalel¶ that is, Ham, al, el, Ham the sun, shewing that the ancient religion of this island, in short every thing in this country, savours of Chaldaic and Egyptian institution. The religion of the Arabs was entirely Zabian. In the first ages of the world, and down until comparatively modern times, the Deity was adored only in the open air. It was held unlawful to build temples to the gods, or to worship them within walls or under roofs.** When any signal favor had been received, the usual custom was to erect a stone in remembrance of the blessing and the ground on which these stones were placed, was supposed to be hallowed.†† The Druids of Europe, who were most undoubtedly Zabians, raised up these monuments in a circular form. Some of them as at Stonhenge, exist to this day. At Abury, and nume-

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* Encyc. Perth. Art. Mythol.

† Gods of Greece, Italy and India, p. 424, vol. 1, Asiat. Res. of the Indian relig. and phil. &c.

‡ Prideaux. § Moreh Nevochim. ‖ Prideaux 1. p. 242.

¶ Bryant Anc. Mythol. ** Taeitus de Moribus German.

†† This custom prevails in the south sea islands until now.

rous other places, they still exist, but it is in the Scottish islands, the Orkneys, at Classirniss, and various other places, that they are found in the finest preservation. In France, and on the continent, they are to be met with, and we may suppose they were used for the same purposes in Europe as in Asia.

In the British islands, single pillars called by antiquarians *Lithoi* are found. *"There are in the Highlands of Scotland and in the adjacent isles, numerous obelisks, or stones set up on end, some thirty, some twenty four feet high, and this sometimes where no such stones are to be found; Wales being likewise full of them, and some there are in the least cultivated parts of Britain, with very many in Ireland. In most places of this last kingdom, the common people believe these obelisks to be men transformed into stone by the magic of the Druids. This is also the notion of the vulgar in Oxfordshire of the rollright stones, and in Cornwall of the Hurlers, erect stones, so called, but belonging to a different class from the obelisks of which I now discourse. That obelisk if I may so call it, in the parish of Braras, in the island of Lewis in Scotland, called the Thrushel stone, is very remarkable, being not only above twenty feet high, which is yet surpassed by many others, but likewise almost as much in breadth, which no other comes near." In Penrith churchyard there are two of these Lithoi; but one at Poitiers in France exceeds all that there are in England, being sixty feet in circumference, and *raised upon* the tops of five others, though this belongs to the kind of obelisks called Cromleachs. Travellers still bring from Egypt pillars of this kind, with hieroglyphic dedications to the sun. The Bacchus of the Thebans was a pillar. The god of the Arabians is reported by Maximus Tyrius to have been a square block of stone; such likewise was the first Jupiter of the Romans, who was carefully concealed by the priesthood from the people. It was said to have been brought from ancient Troy, where it once stood as the famous Palladium.

With respect to these large masses of stone, which are so plentifully scattered over the British islands, although antiquarians unanimously ascribe them to human agency, yet geologists have suspected that they gained their present position by the action of strong currents of water.† They likewise theoretically account for the formation of Lagan or Tottering stones, from the chemical action of the

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* Hist. of Druids.

† No well instructed geologist would now form this conclusion.—*Ed.*

atmosphere upon the feldspar contained in them.* But it would appear, that these explanations are very inadequate to the case, and every person who has attentively considered them, will come to the unbiassed conclusion that they are untrue.

It has been said that there were two great Zabian festivals each year, from which if we attentively consider them, we may perhaps be able to assign a period, approaching to the time of their institution. Tauric festivals were celebrated by the Druids. On the eve of *May day*, all the fires were lighted on the tops of the cairns, and the people leaped through them in honor of Bel. This was an ancient kind of purification, which we find so strictly forbidden in the writings of Moses. In passing, it may be remarked, that Bel was a name of the sun all over the world; Long poles thence called May poles were erected, they were crowned with garlands. This festival was celebrated in honor of the return of Spring. The sun entered Taurus the Bull, and these joyous proceedings welcomed his approach, when the bull opened with his horn, the vernal year. Freret expressly says, these feats of Mithras were derived from Chaldea, where they had been instituted, for celebrating the entrance of the sun into the sign Taurus. There is in the British museum an ancient tablet, representing Mithras killing a bull. The Roman Mithras was exactly the same as the Persian; this is proved by an altar raised to this god, during the third consulate of Trajan, having this inscription, *Mithras deo soli invicto Mithra.* As the Tauric festivities celebrated on May day, were in honor of the commencement of spring, therefore the vernal equinox, at the time when Tauric worship was first instituted, fell on the first day of May, or the sun entered the sign Taurus on that day. Every year the spring commences a little previous to what it did the year before; this arises from the precession of the equinoxes, or from a slow revolution of the poles of the equator round those of the ecliptic. In 25,920 years the pole of the equator makes one entire revolution round the pole of the ecliptic. In seventy two years, the precession amounts to one degree. Therefore if we have the equinoctial or solstitial point given in the ecliptic at any unknown period, it is easy to discover how long that period is passed, by means of the preceding considerations. This method was first proposed by Sir I. Newton, to discover by the position of the Colures, how much time had elaps-

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* Something similar to this is doubtless true in many cases.—*Ed.*

ed since Chiron the centaur lived, and thereby to settle the true time of the Trojan war. When Tauric worship was instituted, the horns of the bull were tipped by the equinoctial colure; 'he then began to open with his horns the vernal year.' But the horns of the bull are now eighty degrees from the equinoctial point, and as it requires seventy two years to recede one degree, $80° \times 72 = 5760$ years, which gives the time since the Tauric festival of May day was instituted.

Jeroboam the idolater set up two calves in Dan and Bethel, and ordained a feast on the fifteenth day of the eighth month. Now originally the year was supposed to consist of twelve months, each month of thirty days, and the remaining five days and few minutes were brought in after a sufficient time had elapsed, to form another month. In their festival calculations the year was supposed to consist of three hundred and sixty six days. The fifteenth day of the eighth month falls on November the sixth. There were two festivals to Bel during the year, the first on the first day of spring, the second on the first day of autumn. The year was divided into four seasons, each season consisting of ninety days. If six days be subtracted from November, (these six were merely added to make the time come nearer the truth,) and then, if two seasons, or one hundred and eighty days be subtracted from the three hundred and sixty, it brings the time of the commencement of spring, or the first Tauric festival to the *first day of May.**

In these remote ages we have every reason to believe, that the true system of the Universe was understood. That the Chaldeans were the first discoverers of the arrangement of the planetary orbs in the solar system, there can be no doubt. At an early period they made an approximative determination of the length of the year, and were able to predict eclipses. Now the mere idea of the path of a planetary body revolving round the sun, or any other star, implies much more extensive acquaintance with theoretical astronomy than might at first appear. The movement of an inferior planet, such as Venus, is to the eye oscillatory, and from the elements deduced from observation of her progressive and retrograde motions, and unequal velocity in different parts of her apparent movement, I do not see how they could convert her oscillatory vibrations into a circular

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* From the Chaldee Saros we deduce their measure of the year to be 365 days, 5 hours, 49 minutes, and 11 seconds, exceeding the truth only by 26″.

or elliptical orbit, without stumbling upon the fact of the attractive force of the sun. We might indeed suppose that the orbits of Jupiter or Mars were first determined, and then those of Venus and Mercury guessed at. But the Chaldeans boasted themselves in their accurate observation, and if we are to give them a credit, which some writers attribute, under the fable of the Phœnix, they hid the theory of cometary motion. For the comet, like the fabled bird of the sun, travels into the interminable desert for a certain but fixed number of years, and then returning burns himself in the sun; but rising from his ashes, and gaining new life from death, he renews his journey, and travels on forever.

In the perpetual and undeviating revolution of the planets, they found an argument for their great doctrine of the eternal duration of matter; but then they had a stronger inducement to study astronomy than we at present know. The stars were looked upon to have their influence on human affairs, and the birth of every man was under the dominion of the spirit of some star; and these angelic influences had moreover their representatives upon earth. Certain vegetables were dedicated to the angels, and iron was sacred to Mars, and silver to Venus, and gold to the Sun.

The hidden virtues of these substances in the cure of human diseases, were early discovered, and this would afford the vulgar a sure proof of the truth of the national faith. But the same powers which could arrest the fatal progress of sickness, might also act as a preservative in cases of incidental nature; this led to Telesms, and judicial Astrology.

There are in the British museum, a collection of small cylinders, an inch or two long, and half an inch in external diameter, the tubular part of them being sufficiently large to put a string through, for the purpose of suspending them round the neck, like beads. They are covered all over with unknown letters, and were brought from the ruins of Babylon. These are the telesms, or protectors from accident and disease. Their magical inscriptions still render them sacred to some star, and doubtless at one time they did really act as they were reported, but their wonderful influence has long ago ceased, because the *imagination* of the wearer, puts no more a faithful reliance on their virtues. They were the predecessors of the Roman Penates.

Of the poetry of the Chaldeans nothing remains. But those men who had held so much communion with the stars, who professed a

religion of angels, and genii, and fairies, and music, who saw in a cloudless sky an unchangeable emblem of the Eternal; surely, if they had not the poetry of words, they had the poetry of thought. For there is a certain sensation in looking out into the heavens above us, which comes upon us in a calm night. I have known what it is, to stand by the nightly watch fires in the wildernesses of the New World; and I can tell what those beautiful maidens felt, who clothed in flowing dresses of the purest white, guarded the sacred fires, which were kept in the forests of Assyria;—the dancing flame, the ascending smoke, the fire-lit countenances, the dark trees, and the bright, the blue, the beautiful sky,—it was poetry.

Some of their fables however, bear a near resemblance to true poetry. The doctrine of transmigration will furnish an example. They feigned that at death the soul drank of the waters of the river of Oblivion, and forgetting all its past life, immediately entered upon a new state of existence. This was most undoubtedly taken from circumstances which come under our knowledge in this life. For no man remembers that early period of infancy, before reason dawns, nor does he recollect what took place before his birth, though he is certain that he was then alive. Poetically speaking, he drinks of the river of Oblivion, and forgets the past.

The more recent successors of the Chaldeans, doubtless taking example from the ancients, embody their philosophical dogmas in poetic language, as may be seen in that extraordinary passage of Hatifi, when alluding to the old astrological hypothesis of a presiding genius over each planet. "He bedecked the firmament with stars, and ennobled this earth with the race of men; he gently turned the auspicious new moon of the festival, like a bright jewel round the ankle of the sky. He placed the Hindoo Saturn, on the seat of that restive elephant, the revolving sphere, and put a rainbow into his hand, as a hook to restrain the intoxicated beast. He made silken strings of sunbeams for the lute of Venus, and presented Jupiter, who saw the felicity of true religion, with a rosary of clustering pleiads. The bow of the sky became that of Mars, when he was honored with the command of the celestial host. For God conferred sovereignty on the sun, and squadrons of stars were his army."

In those regions, including the dominions of Priam, the governor of Troy, and extending almost to the banks of the Indus, which were under the sway of the king of the Chaldeans, nations of every color and every temper might be found. The priesthood in the

course of ages, having become the depositories of knowledge, and having spread their ramifications into every class of society, naturally came to exercise a great political influence, and we find were often raised to have civil dominion in the state. When the hand writing was on the wall, on the night of the fall of Babylon, the soothsayers, enchanters, astrologers, sorcerers, and Chaldeans were assembled; and when Daniel read the mysterious words, the mistaken king commanded them to put a chain of gold around his neck, and they made proclamation concerning him, that he should be third ruler in the kingdom. The luxury and magnificence of the feast on that fatal night, gives us some idea of the civilization of the Babylonians. The vessels of gold and silver, the wines, and the Indian fruits, and the Assyrian concubines that danced before the king, while the praises of Melekta were sounded by flutes, and chanting men from beyond the Ganges, and the harp, and pipe, sackbut, psaltery, and dulcimer, completed the merriment and revelry of that pageant.

To be continued.

ART. II.—*Ascent to the Summit of the Popocatepetl, the highest point of the Mexican Andes,* 18,000 *feet above the level of the Sea.**

Remark by the Editor.—We gladly embrace an opportunity to insert a notice of a volcano of which so little is known.

Mexico, May 15th, 1834.

The valley of Mexico is one of the most picturesque in the world; it is bounded on the S.S.E. by a range of mountains, from which two volcanos rise up, known by the Indian names of Iztaciuhatl and Popocatepetl. Their peaks, always covered with snow, are at sixteen and eighteen thousand English feet above the level of the sea. The crest of the former, the nearer to Mexico, runs from N.W. to S.E., and is irregularly rent. The latter is a perfect cone. It somewhat resembles Mount Ætna, but does not, like that mountain, rise from a plain. The Popocatepetl is on the side of the platform of

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* London Athenæum, Nov. 15, 1834.—This interesting narrative is translated from a letter addressed by Baron Gros, Chief Secretary to the French Legation in Mexico, to a friend at Paris

the Cordilleras Mountains. On one side, the N.W., the forests of firs which surround it terminate at the foot of the valley, and the last trees are mingled with the wheat, Indian corn, and such other European plants, as grow at that height; but, towards the S.E. the forests continue farther down. They, however, become gradually thinner, very soon disappear altogether, and are superseded by the sugar-cane, the cochineal-tree, and all the rich and varied vegetation of tropical regions. A traveller, by starting from the volcanic sands, a little above the boundary of vegetation, and coming down in a straight line into the valley of Cuautia-Amilpas, would in a few hours have gone through all climates, and could gather all the plants which grow between the Pole and the Equator.

It follows from this, that the snow which is on the S.E. side, must in certain cases be influenced by the breezes of warm air, which constantly rise up from the valley of Cuautia. The snow partly melts in the dry season, and whilst the north of the volcanic cone is perpetually covered with snow and ice down to the firs nearest to the top of the volcano, the lava porphyry on the south side are bare.

This, therefore, is the side on which to look for a passage when wishing to ascend to the summit of this mountain, the highest in North America. I tried it last year with a different result.

You know how my first attempt proved unsuccessful. M. de Gerolt and myself were overtaken by one of those tropical storms, of which in Europe you can form no idea. It became indispensable to pass the night amongst the wet firs which grow on the brink of the sands; we had but a cloth stretched with cords over a tree half thrown down, to shelter us from the rain, the hail, and the snow, and we considered ourselves fortunate in having thought of wrapping up our clothes, for a change, in the cloth which was destined to be so useful to us. You have probably not forgotten the storm over our heads, and that which rent the trees below us, and those horizontal flashes of lightning which produced so disagreeable an effect upon my travelling companion; and then our six hours idle walk in the snow, after having been abandoned by our guides, and our blindness for several days, brought on by the reflection of the sun, and our fatigues, our sufferings, our want of courage, the loss of strength, and in fine the painful necessity of giving up our enterprise, when we had but twelve or thirteen hundred feet to climb before arriving at the summit, the promised land.

This year we have met with nothing of the kind; we have had a run of the most favorable circumstances. We profited by the experience of last year, and the 30th April at thirty-seven minutes after two in the afternoon, I planted on the highest peak of the Mexican Andes a flag, which had never floated on so high a spot before.

We had finished all our preparations in the beginning of April; we had barometers, a miner's compass, for want of a theodolite, which is too heavy to be carried up to such a height, some thermometers, one of those little *æolipiles* by Breuzin for heating water, a good telescope and a hygroscope. All these instruments had been compared with those here, belonging to General D. Juan de Orlegozo, and to Professor D. Joaquim Velasquez de Leon, in order to enable us on our return to compare the results of the experiments made at the same hours by those gentlemen at Mexico, and by us whilst on our journey. I had a tent made for shelter; and we were supplied with hatchets, saws, ropes and iron-shod bamboos: these latter are indispensable in expeditions of this nature; mine was fifteen feet long, and I intended to leave it behind us on the top of the volcano. I took good care not to communicate this project to my companions: it was possible we might fail in our expedition, and I did not wish to sell the lion's skin before I had killed the lion.

On the morning of the 15th we started; we had with us three Mexican servants and three dragoons—we each had a second horse and a mule of burthen. In two days we reached Zacualpam-Amilpas, where Mr. Egerton, an English painter, who was to be of the party, soon joined us. We had planned to remain at this place until the time should seem most opportune for making the attempt.

Whilst waiting for the so much wished-for opportunity, I spent my time in carefully examining with the aid of a telescope, the summit of the volcano, and I made drawings, as accurately as possible, of the rocks, the ravines, and the courses of the lava which are on this side. We then searched on the paper for the direction which promished the most success, for we well knew the guides would leave us the instant we reached the perpetual snow.

At length, on the 27th, we commenced our march, and reached Ozumba at three in the afternoon. We sent for the same guides we had made use of last year. They are Indians of the village of Atlautia, which is at the very foot of the Popocatepetl: we took three. We laid in provisions for four days, and the next morning by seven o'clock we had begun, with our mules and horses, to ascend the

mountain. At one o'clock we arrived at the Vaqueria, a veritable Swiss *chalet*, which is used as a shelter by the keepers of a numerous herd of cows, and is the last inhabited spot on the mountain. At three o'clock we arrived at the point where vegetation ceases: this we did by ways which might almost be said to be beaten, for we had occasion but once to make use of our hatchets. As you are acquainted with the Alps, I have nothing to say on those admirable forests of oak, of firs, and of larch, which we passed through. They resemble each other in both hemispheres except that at the foot of these there are large flocks of *guacamaias*, (a large green parrot with a red head,) which are not to be met with at Chamouny or at Sallenches. There are also in the forest, *jaguars*, wolves, deer, and a great number of wild cats, but we did not see a single one of these animals.

As you get higher up in the wood, the fir trees become scarcer, and of less size. Near the sands they may be said to be dwarfs, and all the branches are bent downwards, as if seeking below a less rarefied air. After these firs, for the most part lying down and nearly rotten, you meet but with some tufts of a sort of currant-tree, with black fruit: and then here and there clumps of a yellowish moss, which grows in a half circle in the midst of scattered pumice-stone, lava, and basalts—in short, there is no longer any vegetation, and I did not even see lichen on the rocks. One then begins to feel that he is in a sphere wherein it is not possible to live. Respiration is difficult: a certain melancholy, which is not without its agreeableness, comes over you: but, in truth, I cannot exactly define the sensations I experienced when entering these deserts.

The instant you have left the wood, about one-third the height of the volcanic cone, you see only an immense extent of purple sand, which is in some parts so extremely fine, that it is blown by the wind into the most perfect ridges. Blocks of porphyry, scattered here and there, break in upon the monotony of the scene. The top of the undulations in the sand is crowned with numerous little pumice-stones of a yellowish color, which seem to have been heaped up by the wind. In short, from the summit of some of the volcanic rocks, masses of porphyry and black lava descend, intersecting the ridges of sand, and lose themselves in the forest. The highest part of the volcano is completely covered with snow, and this snow has a so much more brilliant effect that the sky is of a blue almost black. A few footsteps of wolves and jaguars were visible on the sands near the wood.

After having for a short time admired this sad and singular sight, we returned into the forest; the tent was pitched near the prostrate tree where we last year passed so dreadful a night; fires were lighted, and, whilst our *mosos* were preparing our beds and repast, we endeavored to get a little higher up, in order to accustom our lungs to breath an air so little congenial to them.

We had returned by six o'clock. Fahrenheit's thermometer was at 50°. The barometer at 19.120 (English inches); water boiled at 90° of the centigrade thermometer. The humid zone of the hygroscope appeared at 36°, and disappeared at 37° of the interior thermometer, whilst the exterior marked 50°.

Having finished our experiments, we made our preparations for the next day. In the night we suffered from the cold.

On the 29th, at three o'clock in the morning, we started, with a fine moonlight, warmly clad, the face and eyes sheltered with green spectacles, and a gauze of the same color, which wrapped up the whole of our heads. Of my flag I had made a belt. We were seven: the three guides already mentioned, M. Gerolt, the Prussian Consul General, Mr. Egerton an English artist, Luciano Lopez, his Mexican servant, and myself. We each of us had a little bag containing bread and a flask of sugar and water. The Indians carried our instruments, and some provisions. We walked behind each other, taking care to tread in the same steps as the foremost guide, in order to have firmer ground. Of course each man carried his iron-shod bamboo. We advanced very slowly, and were obliged to rest at about every fifteen paces to take breath. The sugar and water were of immense service, for, being obliged to keep the mouth open to breathe, the throat became parched, and a few drops of sugar and water, every five minutes, prevented the pain from becoming unbearable. We zig-zagged and went sideways: the ascent is so steep, that it would have been dangerous, and next to impossible to have gone up in a straight line.

By the time the sun appeared above the horizon, we had reached a great height, when we observed a singular phenomenon, but such as has already been seen on the banks of the Rhine. The shadow of the whole of the volcano was completely visible on the atmosphere. It was an immense circle of shade, through which we could see the whole country to the horizon, and which rose afterwards far above it, terminating by a vapor moving from south to north, the circle descending and becoming more and more transparent as the sun rose, and in about two or three minutes it was entirely dispersed.

At nine o'clock we reached the celebrated Pico del Fraile, beyond which we could not get last year. Our names which we then imprinted with a hammer, remained perfect, only the first letters, towards the west, were become of a clear yellow color.

This peak is a pile of reddish circular rocks, such as is to be found on one of the crests which runs down from the summit. Its perpendicular height is from eighty to one hundred feet, the diameter is about fifty. It terminates in a point, and is distinctly visible from Mexico.

Our guides had consented to go thus far, but nothing could induce them to go farther. I do not think they were more tired than we were, but certainly they were under the influence of some superstitious fear.

Our way to the Pico was long and fatiguing, but not dangerous. We had not yet met with any snow, and it had not yet been necessary, as last year, to climb up with our hands. I felt less oppression than I had feared I should, and my pulse beat but 120 per minute. We were full of courage, had plenty of time before us, and the clearest sky.

We had planned to halt at the Pico del Fraile, and to recruit our strength by a light breakfast. I thought it would be imprudent when at that elevation to eat much, or to drink spirituous liquors, for the the nervous system is excited to an inconceivable degree. We, therefore, took no more than a little bread, and a little of the white meat of a fowl, with a glass of weak wine and water; and after one hour's rest at the foot of the Pico, we resumed our journey.

At nine o'clock the thermometer was at four centigrade degrees; the barometer at 16.472; water boiled at eighteen centigrade degrees. I did not make any hygrometrical observation. The sky was of a much darker blue than on the preceding day. Unfortunately, we had no instrument wherewith to measure its density.

At ten o'clock we were on our way without our guides, and, having to carry our instruments, we found them tremendously heavy.

It is necessary to pass in front of the Pico, and to turn round it on the right. After having got beyond the Fraile, there is, on the left, or rather on its prolongation, a crowning, which terminates at a mass of rocks which exfoliate like slate. They rise up to about 150 feet perpendicular. The summit is covered with snow, and long stagonites of ice fill up the crevices. There is no outlet on this side. On the right is a tolerably deep ravine, which, from afar, we had taken

for the remains of a crater. It extends in a straight line from the top of the volcano to the nearest fir-trees, and is intersected with basalts of lava and porphyry, and, at particular places, is crossed by perpendicular walls of rock and immense heaps of snow; but it was easy to see that, by making some circuits, the summit of the volcano might be reached that way. We, therefore, went down into this hollow, and, without losing sight of one another, each took different roads: M. de Gerolt the middle; I walked on the left, and Mr. Egerton, with Luciano, between us. I thought mine to be the best path, but I was mistaken; I nearly broke my neck a hundred times; and, if I again undertake the journey, I shall go by the bottom of the ravine.

When we could get upon the snow, we walked with greater facility. It was furrowed by the wind and sun, and was like a fresh-ploughed field; and as the furrows were parallel to the horizon, they served as steps. On the sands and rocks there was real danger, for the least inattention or false step would have been fatal. At twelve o'clock we had reached the summit of those perpendicular rocks I have before mentioned; but our strength was beginning to fail us, and, after every eight or ten steps, we were compelled to make a long rest to take breath, and to allow the circulation of the blood to quiet itself a little.

Though we were in the midst of snow, we felt no inconvenience from the cold, except when drinking, or when we touched the metal parts of our instruments. But it was necessary to call aloud to be heard at twenty paces; the air was indeed so rarified at that height, that I tried in vain to whistle, and Mr. Egerton had the greatest difficulty in obtaining a sound from a small horn he had brought with him.

At half-past two M. de Gerolt was on the highest point of the volcano. He skipped about with joy, and made me a sign indicating that there was an abyss at his feet. At thirty-seven minutes after two o'clock I had attained the summit, and I was on the highest edge of the crater. Here all my fatigues were over; breathing was no longer difficult; I was body and soul absorbed in the sight I had before me, and I felt a new life. I was in a state of supreme satisfaction, difficult to be described; and I also leaped in my turn, to encourage Mr. Egerton, who still had some awkward passes to get over.

The crater is an immense abyss, nearly round, bulging considerably to the north, and with some sinuosities to the south. It may be *a leagrue* in circumference, and eight hundred or a thousand feet in perpendicular depth. Its edge is not horizontal; it declines towards the east with sufficient steepness to create a difference of one hundred and fifty feet in the height of the two opposite points. Notwithstanding this, the diameter of the center is so great, and the height at which it is so immense, that, from whatever part of the plain you look at the volcano, that part of the edge which presents itself to your view always appears to be the highest.

The walls of the abyss are perpendicular. Three large horizontal strata are perfectly visible, perpendicularly striped at almost equal distances by black and greyish lines. The bottom is a funnel formed by the detached parts which have from time to time fallen down, and which now do so daily. On the inside of the edge, down to fifteen or twenty feet, are layers, black, red, and whitish, very thin, supporting blocks of volcanic rock, which, however, fall occasionly into the crater. The bottom and the inclined plane of the funnel are covered with an immense quantity of blocks of pure sulphur. From the middle of this abyss, masses of white vapor ascend with great force, but disperse when about half way up the crater. Some also escape from openings in the slope of the funnel, and others from seven principal fissures, between the layers which form the very edge of the crater; but these do not rise to above fifteen or twenty feet.

The openings in the bottom are round, and surrounded by a circle of pure sulphur. There is no doubt that these vapors, which escape with so much force, must carry with them large quantities of sulphur in a state of sublimation, which are deposited on the stones and around the vent-holes. So much sulphurous acid gas escapes, that it was offensive to us on the summit. The exterior of the edge of the crater is free from snow; but within, on the side whereon the sun does not shine, there is a quantity of stagonites of ice down to the beginning of the third stratum. The highest summit of the volcano is a small platform of about twenty feet diameter, with some of that purple sand which is so abundant at the base of the cone.

You will easily feel how imposing such a sight must be. Such masses of lava, of porphyry, of red and black scoria, those whirlwinds of vapor, those stagonites, the sulphur, the snow; in short, this strange confusion of ice and fire which we met with at eighteen thou-

sand feet in the air, remarkably excited our imaginations. We should have liked to have gone all round, but we had not time, and I believe we had not sufficient strength.

At three o'clock the thermometer was at —1 —4 centigrade. The moist belt of the hygroscope appeared at 34°, and disappeared at 33° of the interior Fahrenheit thermometer, whilst the exterior thermometer was at 40°.

In consequence of the violence of the wind, we were unable to light the spirit-of-wine lamp for boiling water; but that which was much more unfortunate was, that in turning over the barometer for the purpose of running the quicksilver into the ball, some globules of air got into the tube: the instrument became comparatively useless.

If you read attentively the description I have given you of the volcano, you will, no doubt, be struck with two things. The first is the singular disposition of the apertures through which the vapors exhale. They are at the bottom, and in a circle; so that those yellowish walls, a thousand feet high, and a league in circumference, appear as a screen to chimney flues conducting the vapor to the highest level of the ground. The second is the extraordinary coating of the interior of the crater. All those layers of lava, of sand, of stone, which form the mass of the volcano, are of the same nature on the outside as on the inside of the crater;—on the outside, however, all is black, purple, and red; whilst on the inside a dirty white and yellowish hue prevails. There is therefore either a decomposition of the volcanic substances by the sulphurous gas, or a deposit of sulphur on the edges—perhaps both. We unfortunately could not get any of these whitish substances; and M. de Gerolt, who tried, was near paying dearly for his imprudence. He had descended by an inclined plane into one of the rents of the crater; but the sand was giving way under his feet, and he was sliding down towards the abyss, when he was fortunate enough to save himself with his iron-shod stick. It would, no doubt, have been magnificent to have had such a grave; but my travelling companion's ambition did not seem to extend so far.

If we were well agreed on this point, there was one on which we were not equally so. This was a strong and prolonged *noise*, which we heard at times from the interior of the volcano. We felt no motion, and nothing was thrown up from below. M. de Gerolt admitted that this noise was such as might be made by detached stones from the upper part of the crater falling down on the inclined plane

which forms the bottom; now I twice *saw* blocks of a tolerable size detach themselves: I watched them as long as it was possible, and the noise we heard corresponded precisely with the shocks they met with in falling. I therefore think that the kind of lengthened detonations which occasionally occurred, proceeded from similar causes. M. de Gerolt spoke of subterranean action, and of the expansive force of vapor. We were perhaps both right, for if, owing to causes easy to conceive, the stones were to obstruct the vent-holes, the vapor would not be long ere it would disengage itself with violence and *noise* from the obstacles opposed to its passage.

You have doubtless read in the histories of the Conquest, that Don Diego Ordaz, one of Cortes' officers, went up to the volcano for sulphur to make powder. There were perhaps at that time some fissures on the side of the mountain where it deposited itself, as is now to be seen in Italy. I do not think it is possible to get at that which is in the crater; and it is probable that in Fernand Cortes' time the volcano was more active than at present. There are millions of quintals of sulphur at the bottom of the funnel; the air is infected by the emanations. I have no doubt, that a person let down would be suffocated by the sulphurous vapor before having reached a depth of two hundred feet. Now, two hundred feet are not a fourth of the distance to the yellow masses which cover the bottom. Even supposing that one could breathe therein, the ropes required to go only to the nearest inclined plane would have to be of a prodigious length; and how are they to be got up to the top of the volcano, when it is so difficult to get there oneself, and that the least weight is almost an intolerable burthen? I am therefore of opinion, that if Diego Ordaz gathered sulphur on the Popocatepetl, it could only have been at a little above the volcanic sands, and not in the crater.

By half-past three we had terminated our experiments, made sketches, and fixed our flag on the highest point of the volcano. At four o'clock we were in the hollow way opposite the Pico del Fraile, where our guides were waiting for us. We made them a sign to return to the tent, and we continued to descend by a different route from that which we had ascended. At five we were on the borders of the wood. We observed several blocks of porphyry which had fallen recently from the summit; probably at the time of the earthquakes on the 13th and 15th of March. They had made a deep furrow from the top of the sands to midway down the mountain; but

as the accelerated motion had caused them to rebound in rolling to the place where they were, their further progress was marked by deep holes made at each rebound. At six o'clock we were under the tent, but too tired and too much agitated to be able to sleep. When awake I spoke of the crater; and if I contrived to get to sleep, the oppression came on again, and I suddenly awoke.

The next morning, 30th April, at seven o'clock, the camp was broken up; at nine, we were at the Rancho, and at twelve, at Ozumba.

We collected a large quantity of plants and flowers in the forest: amongst others, a shrub, which I think has not yet been described, nearly similar to our red laurel, but the flowers of which are like our lily of the valley, white clusters with a reddish hue.

In the court-yard of the house we lodged at, at Ozumba, I put up a telescope, looking on the summit of the volcano; and for two days this court-yard was filled with persons who came to take a view of our flag floating in the wind. By this means I gave an undeniable proof of what we had done,—a thing indispensable in a country where the people are not disposed, and for very good reason, always to believe what is told them.

On the 2nd of May we were in Mexico, recovered from our fatigues, and very well pleased with our excursion. We shall repeat it in the beginning of November.

In short, the Popocatepetl is a volcano, whose fires are not dead, though its eruptions must have ceased many centuries before the conquest. * * *

[Here follows an abstract of the foregoing observations. We shall extract only what is new.]

Over-head the sky was of a blue nearly black; the horizon was at a prodigious height, almost confounding itself with the sky. We could distinctly see Orizaba to the east, and the volcano of Toluca to the west; Mexico and its lakes appeared at our feet; the Izlaciuhatl we saw without its presenting any appearance of a crater: finally, I do not think that I exaggerate when I say we could see for 60 leagues around us; but all was confused, and as if in a transparent fog.

We were excessively fatigued. I had a violent head-ache and a very strong pressure on the temples; my pulse was at 145 per minute,—only 108 after taking a little rest; but I was very little more oppressed than when at the Pico del Fraile. We all four were

deadly pale; our eyes sunk in their orbits, and our lips were of a livid blue. When we rested on the rocks, with our hands above our heads, or lay down on the sand, with our eyes shut, our mouths open, and without masks, we looked like so many dead bodies. Although aware of this beforehand, I experienced a very disagreeable sensation when closely looking at one of my companions.

At the Pico del Fraile we saw, as last year, a crow; and when we had reached the summit, we saw two of those birds flying at two hundred feet below us. As far up as the Pico, which is the boundary of the perpetual snow, under the stones which have preserved some moisture, are to be found a species of large woodlice, nearly in a torpid state. They are the last living things we met with on the ground.

We are not the first persons who have reached the top of the volcano. Many attempts have been made, which have failed from different causes. When arrived at a certain height, some travellers have been seized with a vomiting of blood, which compelled them to abandon their enterprise. In 1825, and in 1830, some Englishmen reached the crater. Mr. Glennie (William) was the first, I believe, who reached it. He gave a plain straightforward account of what he had seen; but a friend of the marvellous got hold of it, to enlarge upon and publish in the Mexican journals. Mention is therein made of columns, of porticos, of Chinese bridges of ice, of which we saw nothing, and of continual eruptions, none of which took place before us.

Art. III.—*On the Resistance of Liquids to Solid Bodies moving in them;* by A. Bourne.

This is an interesting subject of inquiry, and that branch of it which relates to the greatest practical velocity of boats and vessels, appears to be of great importance. Circumstances have occurred, within a few years, which have invested this subject with novelty and interest, sufficient to engage the attention of scientific men, and rouse them from the apathy which generally attends the investigations of physical facts and relations, which were supposed to have been well ascertained. It has been observed, when a boat moved in a canal at the common velocities of three, four, or five miles an hour, that a wave preceded her, and greatly retarded her mo-

tion; and that if the boat was urged to a velocity of ten, or twelve miles an hour, the wave entirely subsided, the bow of the boat being gradually raised out of the water as the velocity increased, and that a less proportional force was required to move her at the greater, than at the lesser velocities.

These were all received as startling facts, and caused much theoretical speculation; but they are only such effects as should naturally result from the laws of resistance, which have been determined with considerable accuracy, and some of the effects intimated long ago, by the French philosophers, to wit; by D'Alembert, in 1743; by La Place, in 1776; by Bossut, in 1778; by La Grange, in 1786; by Coulomb, in 1800, and by many others at different times in other countries.

La Grange ascertained, that a wave of water, where it was one foot deep, moved 5.495 feet per second, and that the velocity of waves of water of different depths, are as the square roots of the depths; consequently, the wave in a canal which is four feet deep, will move 10.99 feet per second, or about seven and a half miles an hour. As the time in which a pendulum performs its oscillations is in a certain proportion to its length, and not in proportion to the magnitude or intensity of the force which first caused its motion; so the velocity of waves, being a similar motion, is in a certain proportion to the depth of the water, and not to the impulse of the boat which produces them. We ought therefore to expect, as the legitimate consequence of the long established premises—that as the velocity of the wave in a canal depends only on the depth of the water, the boat, when urged with a greater velocity, must pass ahead of the wave, which will then subside—the cause of its rise and continuance having ceased to act.

We here refer to ordinary circumstances, where the breadth of the canal is three or four times the breadth of the boat, so that the wave has its natural action, and not to a canal so narrow, that the boat necessarily pushes the water before her like a piston.

The partial rising of the boat out of the water at great velocities, is caused by the inertia and the mutual attraction of the particles of the liquid, and because the air opposes comparatively, very little resistance, or about seven hundred times less than water.

If we take a solid body whose specific gravity is equal to, or greater than that of water, and put it into the water very slowly, we perceive but very little resistance; but strike the water with great ve-

locity, and we find the resistance to be nearly as great as when we strike a solid rock, because it requires a certain time for the particles of any liquid to move among themselves; and if the boat moved with a *very* great velocity, she would of course, rise entirely out of the water, and slide on it as though it were ice.

If the boat and water were covered with clarified oil, she would, from the same cause, descend under the water; because the oil would cause a resistance about seventeen times greater than the water; and if the water and boat could be practically covered with alcohol without mixture, the boat would have a small tendency to rise at great velocities, because the resistance of alcohol would be but one third of the resistance of water. The laws of the resistance of liquids, in all the various circumstances in relation to it, have not been ascertained with the accuracy and precision which the present state of knowledge of other subjects seems to require; this may be owing in part, to some hasty generalizations of the early philosophers, and also to the abstruse nature of the subject. It is now generally admitted, that the direct perpendicular resistance of a plane surface moving in a liquid of indefinite extent, and in a direction at right angles to the plane, is nearly equal to the product of the square of the velocity, the density of the liquid, and the area of the plane. This may be rigorously exact within certain limits, but may not be true when the velocities are very small or very great. It has also been admitted that when the plane is inclined to the direction of its motion, the resistance is proportional to the *square of the sine* of the angle of inclination. This has been denied, and the resistance stated to be proportional to the *sine* of the angle of inclination. Is it *necessarily* true, that this oblique resistance is proportional to the sines, or some other lines relating to circles or to some power of them? And is it not possible that the proportion may have a nearer relation to some of the properties of a parabola or an ellipse, than to those of a circle?

In 1778, Bossut and Condorcet made many experiments to ascertain the resistance of liquids. The reservoir of water was two hundred feet long, one hundred feet wide, and eight and a half feet deep. They used a solid in the form of a cube, whose side was five feet; it was sunk four feet in the water, and to one of the sides were attached successively, triangular prows or bows of various angles, from twelve to one hundred and sixty eight degrees, and it was moved with different velocities, through a space of ninety six feet.

The results of these experiments exhibit a resistance at all angles, greater than the *squares* of the sines, and also greater than the *sines* for angles between 0 degrees and fifty degrees, but less than the sines, between fifty and one hundred and eighty degrees. The brief account we have of these experiments appears to be defective, in not stating the absolute velocities of the solid; and the method is also objectionable, because with the lesser angles of the prow, a solid of much greater surface and volume was used than with the greater angles, without making any allowance for these items; so that between the angles of 180° and 12°, the surface in contact with the water, (exclusive of the stern,) was increased from 85 to 335.73 square feet, and the volume of the water displaced was increased from 100 to 337.8 cubic feet. If these circumstances are of no consequence, then a very large vessel ought to be as easily moved as a very small one.

We want a set of experiments made with solids, all having the same volume or displacement, but having bows and sterns of various forms, to ascertain what form of bow will displace, and also what form of stern will replace, the given volume of water with the least motive force.

To displace the water, and also to replace it with the least disturbance, is the desideratum. Some attention has been given to the displacement, but very little to the replacement; hence the water lines of boats and vessels, contiguous to the stern and stern-post, are generally concave, which is highly detrimental to fast sailing; because the concavity next to the stern requires a convexity (before we arrive at the section of greatest breadth,) of much shorter radius than would be required if the water line presented a convexity from the stern to the midship section; and these two curves in contrary directions virtually double the inertia of the water—the concavity throws it off at right angles to the vessel, and it then has to assume a new direction, and pass round a curve of shorter radius to approach the stern. The concavity of the stern retards the replacement, by causing the water to pass along a curve instead of a straight line, which is evidently the shortest; and because the water will not even pass along a straight line, in a direction from the broad part of the vessel to the stern post, when the velocity is considerable, but leaves a hiatus or cavity near the stern post, and deprives the vessel of the benefit of the reaction of the water there—a certain convexity in all the water lines near the stern, would therefore improve the sailing.

It may be said that such a vessel would steer badly ; but we hear no complaint of the difficulty of steering vessels or boats with pink, or sharp sterns. All the water lines should be convex in every part of them. As it is generally admitted that the resistance is in some proportion to the magnitude of the angle of inclination, it is evident that a vessel having a sharp bow, will sail faster with a given motive force, than another vessel of the same displacement, with a blunt or obtuse bow. We may obtain a very sharp bow without sacrificing any other good property, by projecting the lower part of the stern and bow in the form of a semicircle, beyond a perpendicular let fall from the fore part of the deck.

About ten years ago, the writer made a model of a pleasure boat upon these principles, but not then residing near any navigable water, the boat was not built.

The breadth was about two sevenths of the length, with a very full midship section and floor of the usual length, and the depth from a deep load water line to the upper side of the keel, was about half the breadth. This depth was divided into four equal parts by horizontal planes, as usual, the edges of which are called water lines, and were all convex in relation to the axis, in every part. The angle of the bow at the first water line was 28° ; at the 2d 38° ; at the 3d 40° ; and at the 4th, or deep load water line, 100°. But by the common method of construction, with the same length and breadth of deck, and a less displacement, the angles would not have been less than 74°, 100°, 140°, and 156°, respectively. According to the results of experiments on the resistance of liquids, a boat or vessel built after this model, would not have more than two thirds of the resistance of one built after the models in common use. The bow of this model was formed by extending the keel to a perpendicular line from the fore part of the deck ; and from a center in this line, a little above the 2d water line, and with a radius equal to the distance from the center to the keel, a semicircle was described, but not quite completed—being met by another curve from the top of the stern of much shorter radius, and in a contrary direction. The profile will be singular but not disagreeable when we are accustomed to it.

The water lines consist of different portions of parabolic curves. The curves of the water lines in the direction from the stem to the stern, were taken from the parabola in a direction from the greatest ordinate towards the vertex. If we draw a rectangle, whose length

is equal to the length of the vessel, and whose breadth is equal to half that length, and on this rectangle construct the common parabola, so that the axis shall be coincident with one of the longest sides of the rectangle, the vertex in one of the angles of the rectangle, and the opposite short side of the rectangle coincident with, and equal to a semi-ordinate to the axis of the parabola; then the proper curvatures for certain portions of the several water lines may be found in this parabolic curve, and it is highly probable that all of them may be designated as being between certain ordinates. Perhaps a parabola of greater dimensions may furnish more convenient curves.

The writer has had some experience in the sailing of boats and vessels—is confident that his expectations might be realized, and earnestly hopes that a vessel may be constructed on the principles assumed.

Art. IV.—*On the Reality of the Rise of the Coast of Chile, in* 1822, *as stated by* Mrs. Graham.

Introductory Remark.—The question of the reality of the rise of coast of Chile, during the earthquakes in that region, in the month of Nov., 1822, is so interesting to geology, that we readily comply with the request of a much respected foreign correspondent, by inserting the subsequent papers in this Journal. As Mrs. Graham, now Mrs. Callcott, gave her name in support of the important statements, whose correctness has been recently denied by a geologist, whose name is deservedly respected and honored, wherever science is known, it is due both to the lady and to geology, that there should be a fair hearing, to which Mr. Greenough will be the last to object.—*Ed.*

1. *An account of some effects of the late Earthquake in Chile, Extracted from a letter to* H. Warburton, Esq. *by* Mrs. Maria Graham.

London, March 4, 1824.

Dear Sir,—I send you, at your request, some extracts from my journal concerning the great Earthquakes which visited Chile, during my residence in that country, in 1822-3.

The first shock, by which the towns of Valparaiso, Melipilla, Quillota, and Casa Blanca, were almost destroyed, and Santiago much damaged, was felt at a quarter past ten o'clock in the evening

of Tuesday, the 19th of November, 1822. It lasted three minutes. I was then residing about a mile from the coast at Quintero, situated on a promontory, about thirty miles to the north of Valparaiso. It was a very clear, still, and moon light night; the aurora australis had been visible, and some lightning had been seen over the Andes. In a few minutes after the first shock, there was another, less severe; and from that time the whole night long successive shocks were felt twice in every five minutes, each lasting from half to a minute. On the morning of the 20th, a little before two, at four, and a quarter before six o'clock, there were three more violent shocks, and the earth continued trembling in the intervals: this day was hot and sunny, with wind; the night was clear and windy. On the morning of the 21st, at half past two, ten minutes before three, a quarter before eight, a quarter past nine, and half past ten; and in the afternoon, at a quarter past one, and at two, violent shocks were felt: the weather of this day was like the preceding. On the morning of the 22nd, at half past four, half past seven, and a quarter past nine, there were violent shocks. A little before ten, three successive loud explosions were heard, like the sound of heavy artillery; the earth trembling very much after each explosion. At eleven there was another violent shock, and between that and one o'clock there were three slight ones; the earth then remained quiet until half past seven: this day there was a thick fog, with cold drizzling rain. On 23rd the shocks were less violent and frequent. On the 24th there were continual Earthquakes until eleven at night. On the 25th there was a severe shock, at a quarter past eight in the morning, and others until a little before ten. On the morning of the 26th, at a quarter before three, there was a shock, which lasted nearly two minutes: this day we had a violent northerly wind, with rain, which was considered very unusual at this season. During my stay in Chile, from this time until the 18th of January, 1823, continual Earthquakes, more or less severe, were felt every day. Those on the 10th and 25th of December, were the most violent after that of the 19th of November. I have learned that after my departure the Earthquakes continued, that they were very violent last July, and had not ceased altogether so late as last September.

The sensation experienced during the more violent shocks, was that of the earth being suddenly heaved in a direction from north to south, and then falling down again; a transverse motion also being now and then felt. There was on the 19th of November a general

tremor felt, and a sound heard like that of vapor bursting out, similar to the tremor and sound which I remembered to have observed at each jet of fire, while standing on the cone of Vesuvius, during the eruption of 1818. The tremor between the shocks was shown to be real by the agitation of water in a glass; and during the shocks, water, or mercury, placed in a glass, was thrown over the edge in every direction. In the house where I resided, the furniture was all displaced, with some degree of regularity, so as to range, not parallel to the walls, which fronted to the north and south, but at a given angle diagonally. The sensations experienced on board the ships that lay in the harbour of Valparaiso, was as if they were moving very rapidly through the water, and occasionally touching the ground. On the first shock, on the night of the 19th of November, the sea, in Valparaiso harbor, rose to a great height, and then receded, so as to leave the small vessels, that were before afloat dry on the beach; it then returned again, but, as compared with the level of the land, not to its original level. All this is stated to have happened in a quarter of an hour.

On the morning of the 20th, all the rivers and lakes connected with them, in consequence of the dislodgement of snow from the mountains, were much swollen. In all the small valleys, the earth of the gardens was rent, and quantities of water and sand were forced up through the cracks to the surface. In the alluvial valley of Vina-a-la-Mar, the whole plain was covered with cones of earth, about four feet high, occasioned by the water and sand which had been forced up through funnel-shaped hollows beneath them; the whole surface being thus reduced to the consistence of quick-sand. At the roots of all the trees, between the surrounding earth and stem, large hollows were seen, into which the hand could be introduced, occasioned by the violence with which the trunks had been lashed to and fro. The bed of the Lake of Quintero was full of large cracks, and the alluvial soil on its shore, was divided so as to look like a sponge. The level of the lake, which, communicates with the sea, had apparently sunk very much. The promontory of Quintero consists of granite, covered by sandy soil. The granite on the beach which is intersected by parallel veins, from a line to an inch in thickness, most of which are filled with a shining matter, but some are only coated with it on their sides, and present hollow fissures. After the Earthquake of the 19th, the whole rock was found rent by sharp recent clefts, very distinguishable from the older ones,

but running in the same direction. Many of the larger of these clefts might be traced from the beach to the distance of a mile and a half across the neighboring promontory, where, in some instances, the earth parted, and left the stony base of the hill exposed.

It appeared on the morning of the 20th, that the whole line of coast, from north to south, to the distance of one hundred miles, had been raised above its former level. I perceived, from a small hill near Quintero, that an old wreck of a ship, which before could not be approached, was now accessible from the land, although its place on the shore had not been shifted. The alteration of the level at Valparaiso was about three feet, and some rocks were thus newly exposed, on which the fishermen collected the scollop-shell fish, which was not known to exist before the Earthquake. At Quintero, the elevation was about four feet. When I went to examine the coast, accompanied by Lord Cochrane, although it was high water, I found the ancient bed of the sea laid bare, and dry, with beds of oysters, muscles, and other shells, adhering to the rocks on which they grew, the fish being all dead, and exhaling most offensive effluvia. I found good reason to believe that the coast had been raised by Earthquakes, at former periods, in a similar manner, several ancient lines of beach, consisting of shingle, mixed with shells, extending in a parallel direction to the shore, to the height of fifty feet above the sea. The country has, in former years, been visited by Earthquakes, the last of any consequence having been ninety-three years ago.

The shock of the 19th was felt as far as Lima to the north, by the ships there riding in the bay of Calao. To the south, it was experienced at least as far as Conception, and to the east, beyond the Andes, at Mendoza, and at St. Juan. The distance from Conception to Lima is about twenty degrees of latitude, or 1400 miles.

I am, dear Sir, your's, &c. Maria Graham.

2. *Extract from Mr. President* Greenough's *Address to the Geological Society, delivered on the 4th of June*, 1834.

The Earthquake in Chile in 1822 has been so much* insisted on, that it requires detailed consideration. Of this event, an account by

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* Bakewell's *Geology*, 4th Lond. edit., pp. 98, 504. and 2nd Amer. edit., pp. 67, 344. Lyell, Vol. 1. pp. 401, 455. De la Beche's *Manual*, 2nd edit. Scrope *on Volcanoes*, p. 209.

Mrs. Graham is inserted in our Transactions. I am deeply sensible of the honor that lady conferred on the Society by her obliging compliance with the request which elicited her narrative, and it is only the importance of its contents which could induce me to subject them to the test of rigid examination.

According to this account, "it appeared, on the morning after the Earthquake, that the whole line of coast, from north to south, to the distance of above 100 miles, had been *raised* above its former level." But by what standard was the former level ascertained? Who, on the morrow of so fearful a catastrophe, could command sufficient leisure and calmness to determine and compute a series of changes, which extended 100 miles in length, and embraced (according to a statement in the Journal of Science), an estimated area of 100,000 square miles? How could a range of country so extensive be surveyed while the ground was still rocking, which it continued to do on that day, and for several successive months? What was the average number of observations per square mile? Who made, checked, and registered them? By what means did the surveyors acquaint themselves with what had been the levels and contour before the catastrophe took place, by which, as we are told, all the landmarks were removed, and the soundings at sea completely changed?

Mrs. Graham states, that by the dislodgement of snow from the mountains, and the consequent swellings of the rivers and lakes, much detritus was brought from the coast; and further, that sand and mud were brought up through the cracks to the surface. Amid so many agents, it would not be easy to assign to each its share in the general result.

The fishes lay dead on the shore, may prove only that there had been a storm. In her published travels, Mrs. Graham represents them as lying on the beach, which may very well have been thrown up, as the Chesil bank has been, by a violent sea. Some muscles, oysters, &c. still adhered, she says, to the rocks on which they grew; but we know not the nature or dimensions of these rocks, whether fixed or drifted. The occurrence of a shelly beach above the actual sea-level is an observation which must not be lost sight of. I propose to speak of it hereafter: in the mean time be it recollected, that these beaches are said to occur along the shore at *various* heights, along the summit of the highest hills, and even among the Andes.

Neither in the paper of Mrs. Graham, nor in the anonymous account, published about the same time in the Journal of Science, can I find any paragraph to justify the position (which from the seductive character of the work* in which it appears, may, if not now assailed, soon be deemed unassailable), that a district in Chile, one thousand miles in area, "was *uplifted* to the average height of a foot or more, and the cubic contents of the *granitic mass* added in a few hours to the land." By what means we get the average I do not know. Mrs. Graham says, the alteration of level at Valparaiso, was about three feet; at Quintero, about four feet; but the *granitic mass!*—has the geological surface of Chile been sufficiently examined to assure us that granite extends over one hundred thousand square miles?

In the well-known work of Molini, a Jesuit who passed a greater part of his life in Chile, and wrote a natural history of that country, I find no ground for supposing that in any Earthquakes which took place there, from the time the Spaniards first landed on its shores to the days of his publication, any similar phenomena had been noticed. Moreover, the statement of Mrs. Graham, and the writer before alluded to, respecting the *elevation of land* which occurred during the Earthquake of 1822, has not been confirmed by Capt. King, nor by any naval officer or naturalist who has since visited that region, although many have visited it who had heard the circumstance, and who would willingly have corroborated it if they could. But they saw no traces of any such an event; and the natives with whom they conversed neither recollected nor could be induced to believe it.

The 16th number of the *Mercurio Chileno*, a scientific Journal, contains an account of this Earthquake, by Don Camilo Enriquez, which I have not been able to procure. A later number refers to this account, and to another published in the *Abeja Argentina*, a work of considerable reputation, which, by the kindness of Mr. Woodbine Parish, I have been enabled to consult. The account there given of the Earthquake of 1822, is strongly recommended to the reader, "as a sensible, straight-forward description of what actually took place, without the high coloring in which ignorance, and terror, and exaggeration, are apt to indulge."

No notice is here taken of the permanent *elevation of the land*, and the account concludes thus:—

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* Lyell, Vol. I. p. 473.

"The earth certainly cracked in places that were sandy or marshy; I saw cracks too in some of the hills, but mostly in the low nook where much earth had run together; the sea was not much altered; it retired a little, but came back to its old place. Don Onofri Bunster, who, on the night of the Earthquake, was walking on the shore at Valparaiso, in front of his house, had a mind to go up on the hill, but could not, so great was the quantity of falling dust and stones: he repaired to his boat, therefore, and with some difficulty got aboard; this done, he made observations on the motion of the sea; on sounding, the depth was thirteen fathoms; he heaved the lead a second time, and the depth was no more than eight fathoms: this alternate ebbing and flowing lasted the whole night, *but did not the slightest harm on shore.*"

These are the only cases I remember to have met with, in which the testimony of eye-witnesses has been adduced to prove the rise of land by Earthquakes. That such rise may have taken place, at different times, without being recorded, perhaps even without being observed, is not very improbable; but if I am to pronounce a verdict according to the evidence, I believe there is not as yet one well authenticated instance in any part of the world, of a non-volcanic rock having been seen to rise above its natural level in consequence of an earthquake.

Before I quit this subject, it may not be amiss to mention, that on comparing the times at which the successive shocks took place in Chile, as given by Mrs. Graham, and the other authorities to which I have had occasion to refer, the discrepancy is extraordinary.

3. *To the President and Members of the Geological Society.*

Gentlemen—Mrs. Callcott (formerly Mrs. Graham) has read with surprise, in the Athenæum of June 14, an extract from Mr. Greenough's Anniversary Address to your Society, in which there is an uncourteous attack upon her letter, addressed to Mr. Warburton, in the year 1824, giving an account of the Earthquake which occurred in Chile, on the 19th of November, 1822.

This attack implies, in the first place, a suspicion of wilful falsehood on the part of Mrs. Callcott.—Secondly, it charges her with that high coloring, which "ignorance, terror and exaggeration, are apt to indulge," (the words of the second accusation being quoted from the *Abeja Argentina*).—And thirdly, in case Mrs. Callcott should be prepared to rebut the first and second charges, the insinu-

ation contained in the words quoted below, would tend to throw discredit on her whole statement. "Before I quit the subject, it may not be amiss to mention, that on comparing the times at which the successive shocks took place in Chile, as given by Mrs. Graham, and the other authorities to which I have had occasion to refer, the discrepancy is extraordinary."

Mrs. Callcott, in answer to these observations, begs the attention of the Society, and of Mr. Greenough himself, to the following pages.

The facts detailed by her to Mr. Warburton, and stated more at large in her published journal, are strictly true. Mrs. Callcott had ample means and leisure to examine the coast at Quintero and Valparaiso, places distant from each other thirty miles; and she saw the difference between the old high water marks on the cliffs, beach and rocks, from three to four feet higher than the high water ever reached again during the two months she remained in Chile, after the first great shock. She is indifferent whether Mr. Greenough ascribes this to a partial elevation of the coast of Chile, or to a change of level of the whole mighty Pacific Ocean, which must have extended to Polynesia, India and China: the fact is, that there was a change in the relative position of the land and water; and to save circumlocution, Mrs. Callcott will continue to use the word, raised, or elevated, in describing that change.

Mrs. Callcott has reason to think, that nothing less than a similar catastrophe to that of the night of the 19th of November, will ever restore the land and water to their former relative positions; especially because other sea-shores appear at various heights, well defined on the cliffs of the Heradura Bay, countenancing the idea that they have been hoven up by successive earthquakes. Mrs. Callcott learned, on unquestionable authority, that the earthquake was felt at the same moment she felt it, at Coquimbo and Copiapo, North of Quintero, and at Conception, South of Valparaiso: and had reason to believe, from general reports, that its effects extended much farther in both directions. Mrs. Callcott has, in her letter to Mr. Warburton, and in her published journal, related these facts simply; but she has never, as Mr. Greenough insinuates, stated such an absurdity, as that any one set about, much less accomplished, a regular geological survey of an estimated area of 100,000 square miles on the morrow of that fearful catastrophe, or at any other time.

Mr. Greenough mentions Mrs. Callcott's published journal, and accounts for the dead fish on the shore* by an imaginary storm. Common candor would have led that gentleman to have stated that, in that very journal, it is distinctly printed, that a "delightful and calm moon-light night followed a quiet and moderately warm day.†"

Mr. Greenough says, further in p. 18 of his address—"some muscles and oysters still adhere, she says, to the rocks on which they grew: but we know not the nature of these rocks, whether fixed or drifted." Mrs. Callcott was ignorant that there were, or might have been, drifted rocks, until she learned it from Mr. Greenough; for much as she has been at sea, she never met with one. The rocks at Quintero, and at Valparaiso, are of grey granite, and where they lift themselves through the sand and shingle of the beach, they give the notion of bald mountain tops. At all events, they are fixed sufficiently to have caused the wreck of more than one Spanish ship of war; and when she saw them the morning after the Earthquake, that on which the wreck of the *Aquila* lay, was certainly so far above the water, that the vessel could be approached dry-shod, which had never happened before, even at the lowest tides. The beds of muscles, of other shell-fish, and of sea-weed, were equally rocks of grey granite, fixed far below the sands of the ocean. These circumstances are stated in the published journal: but Mr. Greenough has suppressed them, and many others of the like nature, particularly the notice of some rocks and stones, that the lowest tides never left dry, but have now a passage between them and the low-water mark, sufficient to ride round without difficulty, p. 313.

That Mrs. Callcott's observations were not confirmed by any naval officer, may, perhaps, be accounted for in common candor, by the consideration, that, at the time of the Earthquake, there was not a ship of war, belonging either to England, the United States, or France, on the coast.

Capt. King, whose testimony, had he been present, would have been uncontrovertible, was not on the coast till several years afterwards, and therefore could have had no knowledge of the state of the coast, or the exact soundings, as they existed before.

As to the testimony of the natives, Mrs. Callcott feels sure that Mr. Greenough himself, had he been among them, would attach no value to their testimony, one way or another. *They* assured Mrs. Callcott, that the Virgin Mary had visibly hovered over the sea on

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* Journal of a Residence in Chile, p. 331. † Journal, p. 305.

the night of the 19th, and that the Earthquake itself was a judgment on the country and government, for opening the ports to heretics.

At p. 19 of Mr. Greenough's Address, he makes his quotation from the *Abeja Argentina*, and uses the respectable name of Mr. Woodbine Parish, so as to persuade his hearers, or readers, that he and Don Camillo Enriquez, consider Mrs. Callcott's account as "fraught with the high coloring, that ignorance, terror and exaggeration are apt to indulge." Mrs. Callcott begs to observe, that Mr. Parish was not then in Chile, nor was Don Camillo near the coast, but fully occupied with his business as secretary to one of the parties then engaged in civil war: they could therefore only have had hearsay evidence to place against the statements of Mrs. Callcott, founded upon her own personal observations.

As to ignorance of the science of Geology, Mrs. Callcott confesses it: and, perhaps, that circumstance, and her consequent indifference to all theories connected with it, render her unbiassed testimony of the more value. Terror she cannot plead in extenuation of mis-statement; for she did not, she could not, give way to personal fear on that occasion, because she had with her an invalid relation, under peculiar circumstances, and her whole attention was given to him. She did not lose her presence of mind for a single moment; nor her power of thinking and acting for others. Mrs. Callcott is not apt to exaggerate.

Again, at the same page of his address, Mr. Greenough allows that a person, whom he calls Don Onofri Bunster, was walking the beach, and making observations at the moment of the great shock, at the very time when the great swell of the sea occurred, which threatened to overwhelm the town, and when no man was likely to return alive from such a walk. Yet, Mr. Greenough denies to Mrs. Callcott sufficient composure of mind to observe, several hours afterwards, what had taken place during the night!

Mr. Bunster, who kept a shop, or store, in Valparaiso, was really prevented from going up the hill, as Mr. Greenough states. It happened that that portion of the granite rock, which is the substratum of the red clay or earth which forms the most of the cliffs of the heights of Valparaiso, running immediately under the government house, being disturbed, and visibly cracked, by the great shock, the clay or earth of the low cliff on which the house was built, slipped off on both sides, and, nearly filling up the ravines or quebradas on each side, carried with it the houses formerly on the cliff, and all

those built on the sides. Here Mr. Bunster's statement corroborates that of Mrs. Callcott, although Mr. Greenough makes use of it in contradiction.

Mrs. Callcott must here repeat that, at the conclusion of that portion of his address in which Mr. Greenough's attack on her is contained, p. 19, he says, evidently with a desire to throw discredit upon her—"Before I quit the subject, it may not be amiss to mention, that on comparing the times at which the successive shocks took place in Chile, as given by Mrs. Graham, and the other authorities to which I have had occasion to refer, the discrepancy is extraordinary." Mrs. Callcott, in reply, states, that she had her watch, a very good one, made by Grimaldi and Johnson, chronometer makers, in her hand at the moment of the first shock. She found that her friends at Concon and Valparaiso estimated the time as she did. Several ship's chronometers, which were stopped by the shock, indicated the same moment. Mr. Clarke, an English merchant, whom Mrs. Callcott saw on his arrival at Valparaiso from Conception, told her he had observed the time of the shock at Conception, and that it agreed with that observed at Quintero. Don Fausto del Hoyo, a colonel in the King of Spain's service, and a prisoner on parole, was in the market-place of Quillota when the great shock ruined that town. He also agreed with Mrs. Callcott and her friends, as to the time; and so did the wretched miners of Illapel. As to the intervals between the shocks, Mrs. Callcott kept a register sheet of paper, on which, when she happened to be absent from the spot where the writing materials of the party were kept, some one of the others entered the time and duration of the shock, and the degree of the motion, as indicated by mercury dashing against the side of a glass vessel placed upon the ground; therefore, she presumes that her estimate of the times of the shocks is likely to be, at least, as accurate as that of any person to whose observations Mr. Greenough can possibly have referred.

On reading the extracts from Mr. Greenough's Address, as published in the Athenæum, Mrs. Callcott opened her private journal (which had been locked up for some years), whence both the published travels and the letter to Mr. Warburton were extracted, and read it carefully over, being unwilling to trust her memory, however lively the impression she necessarily received at the time of the Earthquake, of the events that accompanied and followed it. She is happy to say that the daily, nay, almost hourly, entries in the journal,

are such as support all she has printed, or written, or said upon the subject. Twelve years have elapsed since these entries were made; and she feels confident that any stranger, even Mr. Greenough himself, would perceive, on looking over them, in the minuteness of the observations, in the mixture of common and household notices, and the remarks on the progress of the civil war, which was then rife, tokens of that desire for the exact truth, which has always guided her.

Mrs. Callcott would have been happy to have furnished any explanation of what Mr. Greenough thinks doubtful parts of her statements, had he thought it worth while to have made any application to her. And as her relation and friend, Mr. Glennie, a lieutenant in the Royal Navy, no longer an invalid, now resides with his wife in Kensington, Mr. Greenough might have had, what he appears to desire—Some *Officer's corroboration.* (See p. 18 of the Address.) And, moreover, Mrs. Callcott would have been spared the disagreeable necessity of appealing, as she now does, to Mr. Greenough's own sense of justice, and to that of the society over which he presides, for some explanation of his motives for making so uncandid and uncourteous an attack upon her.

Mrs. Callcott cannot feel that it is a light thing to be suspected of wilful falsehood. She made no pretensions to science in any of her statements, nor did she presume to draw conclusions, or frame theories. She stated the facts that came under her own observation, and she must be permitted to claim for herself, one qualification for an observer, namely, a mind more at ease than it was likely most other persons in Chile could have possessed, because she had no family in that country—she had neither political nor commercial connexions in South America—no interests that could be affected, by either the civil war or the Earthquake; while there was not one other person, whose friends or whose property were not, more or less, deeply involved in both.

Mrs. Callcott is very sorry to have been forced to say so much of herself: but she thinks it due to her family and friends, and to the society in which she has always moved, to repel so disgraceful a suspicion, which, if it were in the smallest degree founded, must render her unworthy, either of society or friends.

Art. VII.—*On Turnouts in Railroads with flexible moveable Rails;* by Thomas Gorton, Civil Engineer.

At a time like this, when Railroads are being rapidly introduced in various parts of the United States, it is believed that any improvement relating to the various parts of their construction will be acceptable to the public.

Up to the present time all turnouts upon railroads, (so far as the writer's knowledge extends,) have been constructed with stiff moveable rails. When these stiff rails are moved round so as to make a communication with the turnout and main line a rectilinear angle of several degrees is formed by the stiff rail and main line, which subjects cars passing through the turnout, to much jar and lateral friction. This friction is so great as to injure both cars and railroad. In a late conversation with Mr. E. Miller, Superintendant of machinery on the Portage railroad, he informed me that they proposed using *flexible* moveable rails for their turnouts. The rail adopted on that road is the parallel edge rail, eighteen feet long, and weighing forty pounds per yard. I understood that the plan of their turnouts was not fully matured, but that it was contemplated to have about three feet of the rail made fast in two heavy chairs, and the other fifteen feet to be sprung into a curved form, when it was desired to pass into the crossing or turnout.

This, at once appeared to me to be a decided improvement, in as much as turnouts might be made on this principle, so that cars might pass through them with the same facility as in the curved parts of the main line. In examining the subject, the first requisite is, that the rail at the moveable end should be deflected so as to leave a sufficient distance between the rail of the main line and the fixed part of the turnout. Then secondly, let the radius of curvature for the turnout be determined. It will be seen that these two requisites determine the length of the moveable rails. These rails may then be laid down in the following manner.

Let about one foot of that part connected with the main line be made fast in a heavy cast iron chair, by a wedge and by a bolt passing through the chair and rail. The moveable part of the rail may be supported on chairs; these chairs to rest on cast iron seats having a ledge on one side for the chairs to slide against when the rail is sprung round into the turnout. The seats consequently must be laid

down in the curved form which the rail is to assume in the turnout. If it is thought that the chairs on this part of the rail will work out of place, they may be bolted to it, or secured in some other manner by guides on the seats. The two moveable rails of a turnout should then be connected by two or three stiff coupling bars to give them permanence, and preserve the proper distance between them. The rails may then be worked by a vertical lever of a suitable length. This lever with a ball placed upon its top will serve as an index to persons travelling the road, by pointing out the position of the moveable rails, that the cars may be stopped in time if the rails are not right.

The results of some calculations for rails of different lengths, will now be given, together with the length of a turnout for each kind of rail. These calculations are made for a double track of railroad, the distance between the rails of each track being 4.75 feet, and the distance between the inner rails, including the width of each rail, five feet. But as railroads in general, do not differ much from this in outline, the length of a turnout will not be affected much by such difference.

The following table will be understood from the explanation given therein.

Radius of curvature in feet.	Length of movable rail not including that part in the heavy chair.	Deflection at end of rail in decimals of a foot.	Angle of crossing plates and sine of arc at each end of turnout, in feet.	Feet of straight line in the center of turnout	Length of turnout in feet.
310.	15 feet.	0.36	7° 37.78	40	115
350.	16	0.36	7° 42.65	35	120
400.	17	0.36	7° 48.75	30	128
410.28	17	0.35	7° 50.00	29.6	129.6
450.	18	0.36	7° 54.84	23	133
500.	19	0.36	7° 60.93	17	139
550.	20	0.36	7° 67.03	11	145

In the above table fractions of a foot have been omitted in the last two columns, the object being to give sufficient information in a tabular form, from which a comparison of the advantages, and disadvantages may be made for turnouts with moveable rails of different lengths, and arcs of different radii. An angle of 7° has been adopted in this table for the crossing plate. Increasing this angle would shorten the turnout but little. It is hardly necessary to mention that the plan of the turnout proposed here, is that of an inverted curve, with a piece of straight line in the center.

It is believed that a turnout of from 400 to 500 feet radius, with flexible moveable rails, will be found to answer a much better purpose than those in use at the present time. Several important railroads have curves as abrupt as this. On the Baltimore and Ohio railroad there are two sharp curves, one of 337, and the other of only 318 feet radius.

Art. VIII.—*A new system of Crystallographic Symbols;* by James D. Dana, A. B.

The science of Crystallography has of late years, obtained so great importance, that it is justly entitled to be termed the key-stone to Mineralogy. Its principles, first fairly developed by the Abbé Haüy, have placed this latter science on a mathematical basis, and have afforded, with but few exceptions, invariable points of distinction between the different mineral species. With all the exactness, in many instances, that attends any branch of mathematical calculation, the Abbé Haüy determined the mutual inclinations, and relative situations of secondary and primary planes, and the dimensions of the primitive forms of different minerals. The discovery of these facts led him to introduce symbols and abbreviated expressions, to aid in the description of crystals, by means of which, the position of secondary faces may be stated with far more precision than is possible in a figure. The idea was a happy one. But his system in all its particulars does not seem to be beyond improvement. Indeed, improvements have been proposed by some authors, and systems quite different adopted by others. That by Mohs is certainly ingenious and beautiful. Still there remains one point yet unattained. A system appears to be needed, of which a direct application may be made in lettering the figures of crystals. This accomplished, the student would be enabled by a mere inspection of the figure, to refer any secondary plane to its situation on the nucleus, however disguised it might be. Besides, it would be unnecessary in the description of a crystal, to accompany the symbolical expression of a plane with the letter given it in the figure, (a practice followed by the Abbé Haüy); for the same symbol would be used in both instances.

To propose a plan for the attainment of the above end, will be the object of the following remarks. The great obstacle to it, in the systems now in use, is the length of the representative signs of

planes. Conciseness therefore must necessarily be a peculiarity of any method that will accomplish the desired object. In fact, it will be found that the expressions following from the system about to be proposed, are frequently not one quarter the length usual in other systems.

Before proceeding to the details of the plan, it will be necessary to explain what the situation of a crystal is when in position; that is, so situated that the following laws may be correctly applied in lettering its different parts. In general, the prisms are supposed to be on their bases with a lateral edge towards the observer. It is immaterial which lateral edge of the cube or right square prism is in front, as they are similar to one another, (formed by the meeting of equal and equally inclined planes.) In the right rectangular and right rhomboidal* prisms, the smallest of the lateral faces must be to the right, with any edge of the former, but an obtuse one of the latter in front. An obtuse edge is also to be made the anterior one in the right rhombic prism. In the oblique rhombic and rhomboidal prisms,† let the dominant solid angle be the superior and anterior one. Hence if it is obtuse, an obtuse edge, if acute, an acute edge, will be before the observer. The position of the rhombohedron may be the same that is usually given to that solid; that is with the axis—*the line connecting the vertices of the dominant* solid angles—placed perpendicularly. The above positions are those in which the figures of crystals are commonly given in works on Mineralogy.

With regard to the octahedra, the base must be placed horizontally. Their positions in other respects may be inferred from those of the prisms of the same bases. Thus that of the right square octahedron from that of the right square prism; the right rectangular octahedron from the right rectangular prism; and the right rhombic octahedron from the right rhombic prism.

In lettering the planes of crystals, the letter a, as a general rule is to be applied to those on the angles, e, to those on the edges, and æ, to the intermediary planes. The letters a and e are selected because of the ease with which they may be combined to express the intermediary planes, which, correctly speaking, being neither on the angles nor edges, but rather intermediary between them, may with pro-

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* Usually termed the right oblique-angled prism.

† Usually called the doubly oblique prism, but the base of this and of the so called right oblique angled prism, being the rhomboid, (as this term is used in geometry,) the names I adopt seem preferable.

priety be expressed by a union of the letters of each. Another advantage of these letters, manifest to the English reader, (one of secondary importance however,) consists in their being the initials of the words angle and edge, to planes on which, they are respectively applied.

In all the primitive forms, except the cube and regular octahedron, it becomes necessary to distinguish the dissimilar primitive planes, solid angles, and edges from one another. This may be done by means of Italic, and Roman letters, with the occasional use of dashes according to the following rule. In its full extent it is to be applied only to the *oblique rhomboidal prism.* Modifications of it for the other primitive forms, resulting from the similarity of some of their parts, will afterwards be pointed out.

The crystal being in position; name the superior base P, the right lateral face P′, the dash inclining to the right; the left lateral face P\, the dash inclining to the left. (See fig. 1, which is a full application of the law about to be given.) Designate the front lateral edge and the two superior basal edges by the Roman e, the side lateral and the two inferior basal edges by the italic *e*. To distinguish the superior basal edges from one another, give to the right, the right inclining dash, to the left, the left inclining dash; thus é and è: the same with the inferior basal edges. Thus half the edges of the crystals are named. The remaining half being precisely similar to these, will receive the names of their opposites. To letter the angles, apply the Roman a to the dominant or front superior solid angle, the italic *a* to the supplemental dominant or front inferior solid angle. Also the same italic *a* to the superior lateral angles, distinguishing them by a dash inclining to the right or left according to the situation of the angle to the right or left hand. Thus *á*, *à*. In this way the angles and edges may receive their respective symbols, which will be used in naming planes situated on them.

But it is farther necessary to specify the primitive plane on which a secondary inclines. This may be concisely done by placing below its symbol, the dash belonging to this primitive plane. Thus if it inclines on the right lateral face, plane P′, the dash inclining to the right is to be placed below, and the contrary for an inclination on the left lateral face. Thus a plane on edge é inclining on plane P′ will be named $\frac{é}{}$, &c. To express the intermediary planes, we have but to combine the letters belonging to the angle and edge between which they are situated, and to place below, the dash of the

plane on which they incline. Thus suppose an intermediary to be situated between the edge é, angle a and plane P′, the symbol will be æ′, ; if between the edge è angle *à* and plane P', the symbol will be *à*è, ; if between è, a and P the symbol is æ'. There is no dash below in this instance, as the plane on which it inclines (the base) has no dash to its P.

There is certainly no taxing of the memory here, farther than as regards the use of the italic letters. We have only to notice whether a dash inclines to the right or left, in order to determine the edge, angle and face between which a plane is situated.

These symbols become more simple as we descend from this climax of irregularities among the primitive forms, to those whose similar parts are more numerous. In the oblique rhombic prism the lateral faces are similar to one another, and consequently also the front superior basal edges and the front inferior basal edges. It is therefore unnecessary to distinguish them from one another. Hence instead of P′ and P', each of the lateral planes may be named $\breve{P}$ whose distinguishing mark is virtually a combination of the two dashes used in the oblique rhomboidal prism. So also we have $\breve{e}$ for é and è, $\breve{e}$ for *é* and *è*, and $\breve{a}$ for *á* and *à*. The lateral angles of this primitive form have the two front plane angles (the crystal being in position) equal to one another, but unequal to the two posterior plane angles which also are equal to one another. Consequently a decrement may take place on one pair, and not on the other. Suppose then a plane on a lateral superior solid angle to incline on a front face. Its symbol according to the above rule will be $\breve{a}$. But if it inclines on the posterior face, the curve below must be inverted thus, $\breve{a}$. In the rhombohedron the faces are equal, the superior edges similar, and also the lateral edges. The planes are marked P, the superior edges e, the lateral edges *e*. So also the dominant solid angle a, and the lateral solid angles *a*. If this form were placed in the same position as the oblique prisms, these letters would result by merely dropping the dashes, which here become unnecessary. Two kinds of planes may exist on the lateral angles of the rhombohedron, owing to the two kinds of plane angles which compose it. If the plane cuts off the dominant* plane angle, (these

* As I have called the superior solid angle the dominant or governing solid angle of the rhombohedron, so also its plane angles and their equals in this solid may be named the dominant plane angles.

are the more common planes on the lateral angles,) it will be named according to the above law, that is, there will be no mark below, as none is used in marking the primitive planes. But if the complement to the dominant is cut off, the inverted curve must be used below. Thus if the rhombohedron is obtuse, and a plane cuts off the acute plane angles, (complement to the dominant) from the lateral solid angle, the symbol for the planes will be $\breve{a}$. In the right rhombic and right rhomboidal prisms, the superior and inferior basal edges are similar. The latter must therefore receive the symbol of the former. The italic *e* is still retained for the side lateral or acute edge. It is however unnecessary in the right rectangular and right square prisms, the lateral edges being similar. Hence they are generally designated by e, and for the same reason all the angles are named a.

We have now arrived at the cube, a solid with equal solid angles, equal plane angles and planes, and similar edges. The planes are therefore lettered P, the angles a, the edges e. There is no necessity of distinguishing them from one another. Planes on one edge or angle (with few exceptions to be noticed soon,) are attended with the same number similarly situated on the others. Hence to say, when a solid angle of a cube is replaced by six planes, that it is replaced by one of these six, is saying that every solid angle in the cube is replaced by six planes; and generally with all the primitive forms, similar parts are similarly modified. The exceptions to this law of nature are few; and when they do occur, still a symmetry of parts is always retained. Thus in Boracite four of the solid angles are similarly replaced, while the remaining four are left untouched. It will be observed that these four angles are not all of them on one side of the crystal, but so disposed relatively to one another, that the figure is still symmetrical. This is universally the case. To express the fact that but half of the angles or edges are similarly replaced, we have therefore but to add the fraction $\frac{1}{2}$. Thus $(\frac{1}{2}a)^2$ signifies that half the solid angles are replaced by the planes a^2. More frequently it happens that all the angles or edges are similarly modified, but by half the usual number of planes. Thus it is in the cube, when it gives rise to the pentagonal dodecahedron. The following form may then be given to the symbol, taking this dodecahedron as an example, $\frac{e^2}{2}$, signifying not as in the first case, that only half the edges are replaced, but on the contrary, that all are replaced,

yet by half only of the usual number of planes. Other instances will be found in Fig. 2, which will be noticed in the remarks on that figure.

As a recapitulation the following table is introduced, showing the letters that are to be applied to the angles and edges of the several prisms.

1 *Cube.*	
Planes*	P
Edges	e
Angles	a
2 *Rt. sq. Prism.*	
Lateral planes	$\widehat{P}$
Lateral edges	e
Basal "	$\widehat{e}$
Angles	a
3 *Rt. rect. Prism.*	
Rt. lat. plane	P′
Lt. " "	P‵
Lat. edges	e
Rt. basal edge	é
Lt. " "	è
Angles	a
4 *Rt. rbc. Prism.*	
Lat. planes	$\widehat{P}$
Front lat. edge (obtuse)	e
Basal edges	$\widehat{e}$
Side lat. edge (acute)	*e*
Front solid angle	a
Lat. " "	*a*
5. *Rt. rbdl. Prism.*	
Rt. lat. plane (smallest)	P′
Lt. " "	P‵
Front lat. edge (obtuse)	e
Rt. bas. edge	é
Lt. " "	è
Side lat. edge (acute)	*e*
Front sol. angle	a
Lat. sol. angle	*a*
6 *Rhombohedron.*	
Planes	P
Superior edges	e
Lateral edges	*e*
Dominant sol. angle	a
Lateral " "	*a*
7 *Ob. rbc. Prism.*	
Lat. planes	$\widehat{P}$
Front lat. edge	e
Front sup. bas. edges	$\widehat{e}$
Side lat. edge	*e*
Front inf. bas. edges	$\widehat{e}$
Front sup. sol. angle (dominant)	a
Front inf. " "	*a*
Lat. sup. " "	$\widehat{a}$
8 *Ob. rbdl. Prism.*	
Rt. lat. plane	P′
Lt. lat. plane	P‵
Front lat. edge	e
Rt. sup. bas. edge	é
Lt. " " "	è
Side lat. edge	*e*
Rt. inf. bas. edge	*é*
Lt. " " "	*è*
Front sup. sol. angle	a
Front inf. " "	*a*
Rt. lat. sup. "	*á*
Lt. " " "	*à*

* If it is ever found necessary to distinguish these planes, the dashes may be applied to the lateral faces according to the rules already given.

The dashes to be placed below these letters will depend, as has before been stated, on the situation of the primitive plane on which the secondary inclines. It must be remembered however, that in the rhombohedron, when the plane on a lateral angle cuts off a dominant plane angle, *a* merely is to be used; when it cuts off the other plane angles, the inverted curve is to be placed below as *a*. Also in the ob. rbc. prism, if the plane on a superior lateral angle inclines on one of the anterior faces, the curve line, the distinguishing mark of the faces, is to be placed below. But if it inclines on a posterior face, to distinguish these from the former, the curve must be inverted. Thus $\underset{\frown}{a}$, $\underset{\smile}{a}$, and $\overset{\frown}{a}$ (the latter for planes inclining on the base,) will be the symbols for the planes not intermediary about a lateral solid angle.

A similar table for the octahedra, dodecahedron, and hexagonal prism,* will supersede the necessity of any remarks with regard to them. I would state merely, that in the octahedra the Roman e is applied to the lateral edges, the italic to the basal, the Roman a to the vertical solid angles, the italic to the lateral.

1 *Reg. Octahedron.*		
Planes		P
Edges		e
Solid angles		a
2 *Rt. sq. Oct.*		
Planes		P
Lat. edges		e
Basal	"	*e*
Vertical sol. angle		a
Lat.	" "	*a*
3 *Rt. rect. Oct.*		
Rt. hand plane		P′
Lt.	" "	P‵
Lat. edges		e
Rt. basal edge		*é*
Lt.	" "	*è*
Vertical sol. angle		a
Basal	" "	*a*
4 *Rt. rbc. Oct.*		
Planes		P
Anterior lat. edge		e
Side	" "	$\overset{\frown}{e}$
Basal edges		*e*
Vertical sol. angle		a
Anterior basal		*a*
Lat.	"	$\overset{\frown}{a}$
5 *Dodecahedron.*		
Obtuse solid angle		a
Acute	" "	*a*
Edges		e
6 *Hexagonal Prism.*		
Bas. plane		P
Lat. plane		$\overset{\frown}{P}$
Lat. edge		e
Bas.	"	$\overset{\frown}{e}$
Sol. angles		a

Intermediary planes on these solids are named in the same manner as those on the prisms. Thus in the Rt. rect. octahedron, a plane situ-

* The tetrahedron is not here included, it appearing to be but a secondary to the octahedron. Its symbol referred to the octahedron will be $\frac{1}{2}$P.

ted between P′, *a* and e is lettered *ae*,. An intermediary may incline from an edge to its opposite. No dash below is then required.

Each plane being lettered, there yet remains to be added, numerals expressive of the rate of decrement* that may be considered to have taken place in the formation of the new plane. This may be done by attaching in the form of an algebraical index a fraction whose numerator consists of figures indicative of the rate of decrement along the edges of the plane on which the secondary inclines, and a denominator expressing the decrement in the direction of the other edge or edges. If a secondary plane is on an edge, decrement has taken place on but one edge of the plane on which it inclines. Consequently the numerator will consist of but one figure. Thus we say $e^{\frac{3}{2}}$. The denominator of the index, and the index itself may be dropped when a unit. Hence we write e^{3} instead of $e^{\frac{3}{1}}$, e instead of e^{1}. If the secondary is on an angle, an equal decrement has taken place on each of the edges of the plane on which the secondary inclines, only that on one, need be expressed, the other being implied in the letter a; thus a^{2} instead of $a^{2.2}$. For intermediary planes the decrement in each direction must be stated, it differing in each; as for example, $æ^{\frac{4.6}{3}}$, $æ'^{2.3}$ (the denominator 1, is here to be understood.) The right hand figure in the numerator must be that which expresses the decrement along the edge to the right, supposing the edge, the rate of decrement in whose direction, forms the denominator, to be directly before the observer. It is not very important on which plane we suppose an intermediary to incline. But in general, it is best to select the one, in the direction of whose edges, the greatest decrement has taken place. Of these two edges, that on which the decrement is the greatest, should give its letter to form the compound symbol of the intermediary. Thus if the decrement (see fig. 1) is the least in the direction of e, supposing the plane on angle a, it inclines on P, and if the greatest decrement is in the direction of è, the symbol will be (supposing an index of $\frac{4.3}{2}$, in which 2 expresses the rate of decrement along e, and 4 along è,) $æ'^{\frac{4.3}{2}}$. If 4 expresses the rate of decrement along é, the symbol will become

* It must not be understood that it is supposed that a decrement really takes place in the formation of secondary planes. The word decrement may be considered to refer rather to the rate of decrease according to which the secondary planes *might* be formed on the primitive solids.

$æ'^{\frac{3.4}{2}}$. Still if the first example should be written $æ,^{\frac{3.2}{4}}$ no mistake could be made in the situation of the plane. The dash below signifies that the intermediary is supposed to incline on P′. The numerator will of course express the rate of decrement along its edges, and if the edge è, whose rate of decrement is 4, be placed before the observer, 3 applies to the left edge, edge é, and 2 to the right, edge e.

In the octohedra, the denominator of the index for intermediary planes, will consist of two figures, thus $æ^{\frac{n.m}{o.x}}$; unless the plane inclines from an edge to its opposite, when an equal portion of two opposite edges is cut off, and consequently the situation of the plane will be accurately indicated, by expressing merely the ratio of the parts cut off from the two other edges. Thus $æ^{\frac{n}{o}}$ instead of $æ^{\frac{n.m}{m.o}}$.

Such are the principles of the proposed plan. An application of them will be found in the plate. Some particular observations respecting the figures, and the arrangement of the symbols in a description, will be made after offering a word or two concerning the advantages of the method.

A remark has already been made with regard to its conciseness. A few examples from Brooke's Familiar Introduction to Crystallography, with their proposed substitutes, will exhibit the comparative merits of the two systems, in this particular. Brooke's system may be taken as a specimen of all, as far as conciseness is concerned. The expressions that follow, are each for a single class of planes, as given in his work.

	Brooke's.	Proposed substitutes.
Cube	Class *a*. $^{1}\dot{A}^{1}$	a
	" d. (B3 B‴2 B′1 : B1 B‴2 B′3)	$æ^{\frac{3.2}{1}}$
	" i. (B′q Bp B″r) (B″q B′p Br) (B′r B″p Bq)	$\frac{æ^{\frac{q.p}{r}}}{2}$
Right Square Oct.	Class *a*. $^{1}A^{1}$	a
	" f. (Bp Dq D′q B″r)	$ae^{\frac{p}{r}}$
	" d. (Bp B′q b′r bs : Bp B′r b′q br)	$æ^{\frac{p.q}{r.s}}$
Rhombohedron.	Class b. $^{p}A^{p}$	a^{p}
	" d. (B′p Bq B″r : Bp B′q B″r)	$æ^{\frac{p.q}{r}}$
	" l. (D′p b″r Dq : D′q b″r Dp)	$æ^{\frac{p.q}{r}}$

These will serve as a specimen of his longest and shortest terms, and of the greater conciseness, in every instance, of the proposed substitutes.

The following is the description of a modified right rhombic prism, taken from page 426 of the work above referred to.

$$1G1\ M\ \overset{2}{B}\ \overset{2}{E}\ (B1\ H1\ B'2 : B2\ H1\ B'1)(B1\ H3\ B'2 : B2\ H3\ B'1)\ P.$$

Translated it becomes $e\ \widehat{P}\ \widehat{e}\ \widehat{a^2}\ \widehat{a^{\frac{1}{2}}}\ \widehat{æ^{\frac{3.1}{2}}}\ P.$

The following symbols describe a crystal of Boracite, the edges and half the angles of which are replaced, each by tangent planes. According to the system of the

Abbé Haüy, its representative sign is $P\ \overset{1}{B}\ \overset{1}{A}\ \overset{1\ 0}{a}\ \overset{1\ 0}{e}$.

Brooke " " $P\ \overset{1}{\underset{1}{B}}\ {}^{0}\dot{A}^{0}\ {}^{1}\dot{A}^{1}\ {}^{1}\dot{a}^{1}\ {}^{0}\dot{a}^{0}$.

Mohs " " $H.O.D.\ \overline{\frac{}{2}}$

Whewell " $2(3)1,0,0)+2(6)(\pm1,1,0)+(4)(\pm1,1,1)$.

The proposed substitute is $Pe\ (\frac{1}{2}a)$.

The most important advantage of this system is, that the symbols may be applied to the figures of crystals. It is frequently quite difficult for the student to determine the situation of secondary planes relative to the primary, particularly when the form of the nucleus is entirely concealed. The secondaries of the Rhombohedron may be instanced as peculiarly difficult. This difficulty evidently vanishes, when the figure is so lettered, that each plane may be easily referred to its situation on the primitive form. This as has been already shown, will be accomplished by the proposed system.

Even if the rate of decrement is not determined, still nearly an equal advantage is obtained. The planes on any particular edge or angle, may be distinguished by numerals, thus 1é 2é 3é, &c. In this manner the edge or angle on which a plane is situated, and the plane on which it inclines, may be pointed out.

Fig. 1, has already been explained. If it is remembered that the posterior planes, angles and edges have the same symbols as their diagonally opposites, no difficulty will appear in any part of it.

Fig. 2. A crystal of Iron pyrites. Primitive form. Cube.

Description. $P\ a^{1}|^{2}\left|\frac{æ^{4\cdot2}\left|\frac{6.3}{2}\right|\frac{15.5}{3}\left|e^{2}\right|\frac{3}{2}\right|}{2}\right|.$

The same by Haüy. $M\ M'\ P\ (A^{\frac{1}{3}}\ B^{2}\ G^{1})\ (A^{\frac{3}{2}}\ B^{2}\ G^{1})\ (A^{2}\ B^{2}\ G^{1})$

$(\overset{\frac{1}{2}}{A}\ B^{1}\ C)\ (\overset{\frac{3}{5}}{A}\ B^{1}\ C^{\frac{3}{5}})\ (\overset{\cdot\cdot}{A}\ B^{1}\ C^{2})\ (^{\frac{1}{2}}A\ G^{2}\ C^{1})\ (^{\frac{3}{2}}A\ G^{2}\ C^{1})$

$(^{2}A\ G^{2}\ C^{1})\ B\ \underset{\frac{3}{2}}{B}\ \overset{\frac{3}{5}}{C}\ \overset{2}{C}\ G^{\frac{3}{2}}\ ^{\frac{3}{2}}G\ (A^{\frac{5}{3}}\ G^{1}\ B^{3})\ (\overset{\frac{5}{3}}{A}\ B^{1}\ C^{3})\ (^{\frac{5}{3}}A\ C^{1}\ G^{3})\ \overset{I}{A}.$

a	$= 125^\circ\ 15'\ 51\frac{3}{4}''$	$æ^{\frac{15.5}{3}}$	$= 147^\circ\ 41'\ 18''$
a^2	$= 144^\circ\ 44'\ 8\frac{1}{4}''$	e^2	$= 153^\circ\ 26'\ 6''$
$æ^{4\cdot 2}$	$= 150^\circ\ 47'\ 39''$	$e^{\frac{3}{2}}$	$= 146^\circ\ 18\ 36''$
$æ^{\frac{6.3}{2}}$	$= 143^\circ\ 18'\ 3''$		

In writing the description, the symbol of that plane is placed first, which gives the character to the form of the crystal. In this case evidently, the faces of the cube should precede, as is the case above. As a general rule, the lateral planes of a prism should be first noticed, next the bases, and lastly the planes on the angles and basal edges.

By an examination of the figure, it appears that in five instances, there is but half the number of planes that perfect regularity would require. This is expressed by the figure 2, under the symbols of these five planes.

It will be observed that the figures of the numerator, in some instances, change places with one another. This results from the different situations of the same plane. Were this change not made, the inference with regard to the face on which the secondary inclines, would be incorrect. It may be well to look for a moment at the manner in which the face on which a plane inclines, may be determined from its symbol. Take for instance the plane $æ^{\frac{15.5}{3}}$ situated between the superior base and the left lateral face. It is to be decided on which of these planes it inclines. Suppose it to be on the latter—consequently the numerator should express the decrement along its edges, and the denominator, that in the direction of the right superior basal edge. This being placed towards the observer, 15 the left hand figure, should express the decrement on the left edge, (front lateral,) and 5 the same on the right edge, the left superior basal. But the number to the left, 15, being the greatest, the plane ought to be situated to the left of a plane, on the solid angle, (not intermediary,) which inclines on the same face—which is not the case with the plane under consideration. But if we sup-

pose it to incline on the superior base, its symbol will be found to coincide exactly with its situation. 15 expresses the decrement along the left basal edge, consequently it ought to be situated between the plane a^2 on the angle, and e^2 a plane on the edge; where it really is.

Fig. 3. Native Amalgam. Primitive form. *Dodecahedron.*

Description. $P\ e^{1}|^{2}|a\ a^{1}|^{2}|$.

Haüy's. $P\ \dot{B}^{1}\ B\ A\ {}^{1}E^{1}\ {}^{2}E^{2}$.

e	=	150°		a	=	135°
e^2	=	160° 53′ 36″		a^2	=	153° 26′ 6″
a	=	144° 44′ $8\frac{1}{4}$″				

Description referred to the cube as nucleus, $e\ a^2\ æ^{\frac{6.3}{2}}\ a\ P\ e^3$.

Fig. 4. Idocrase. Prim. form. *Right square Prism.*

Description. $e^{1}|^{2}|\widehat{P}\ Pa^{3}|^{\frac{1}{2}}|^{\frac{1}{3}}|^{\frac{1}{4}}|a^{2}|^{3}|^{4}|\widehat{e}$.

Haüy's. ${}^{1}G^{1}\ {}^{2}G^{2}\ M\ P\ \dot{A}^{6}\ \dot{A}^{2}\ \dot{A}^{1}\ \dot{A}^{\frac{2}{3}}\ \dot{A}^{\frac{1}{2}}\ ({}^{2}A^{2}\ {}^{\frac{3}{2}}A^{\frac{3}{2}}\ {}^{1}A^{1}\ B^{2}\ G^{1})\ B^{3}$.

e	=	135°		$a^{\frac{1}{4}}$	=	108° 18′
e^2	=	153° 26′ 6″		$\underline{a}^2$	=	133° 18′
a^3	=	165° 51′		$\widehat{a}^3$	=	144° 44′
a	=	142° 54′		$\widehat{a}^4$	=	152° 3′
$a^{\frac{1}{4}}$	=	124° 30′		$\widehat{e}$	=	151° 52′
$a^{\frac{1}{3}}$	=	113° 30′				

Haüy's description has been made out on the supposition, that the plane $a^{\frac{1}{2}}$ instead of a, results from a decrement of a single row of particles. Thus he makes the planes $\underline{a}^{2}|^{3}|^{4}|$, intermediary, which according to the hypothesis adopted, are planes on the lateral angles.

Fig. 5. Heavy Spar. Prim. form. *Right rhombic Prism.* $\widehat{P}$ on $\widehat{P}$ =101° 42′

Description. $e\ \widehat{P}\ e^{1}|^{4}|P\ a\ a^{1}|^{2}|^{4}\ a\underline{e}^{\frac{6.3}{2}}\ \underline{e}^{2}$.

Haüy's. ${}^{1}G^{1}\ M\ {}^{1}H^{1}\ {}^{4}H^{4}\ P\ \dot{E}^{1}\ \dot{A}^{1}\ \dot{A}^{2}\ \dot{A}^{4}\ (\dot{E}^{\frac{3}{5}}\ B^{2}\ B^{1})\ P$.

e	=	129° 9′		a^2	=	141° 11′
e	=	140° 51′		a^4	=	158° 2′
e^4	=	166° 53′		$\underline{a}e^{\frac{6.3}{2}}$	=	143° 66′
a	=	127° 18′		$\underline{e}^2$	=	115° 41′
a	=	121° 48′				

Plane $\widehat{e}^3$ is situated on a basal edge, and inclines on a lateral face. Supposing the inclination on a basal plane, its symbol would be $\widehat{e}^{\frac{1}{3}}$.

Plane $a\widetilde{e}^{\frac{6\text{-}3}{2}}$ is situated between the lateral angle, basal edge and basal plane. 6 and 3 will therefore refer to the basal edges, and 2 to the lateral.

Fig. 6. Calcareous Spar. Prim. form. *Rhombohedron.* P on P = 105° 5′.

Description. $a^2 e e^2$. The same by Haüy, $e^2 \overset{1}{B}\ D^2$.

a^2	=	134° 36′ 35″	e^2	=	150° 58′ 16″
e	=	142° 32′ 30″			

In this figure we see not the least resemblance to the primitive form. The letters on its planes, make it apparent, that the lateral angles are replaced each by a plane, giving rise to the lateral faces of a Hexagonal prism, that the superior edges are truncated, and the lateral edges replaced, each by two planes.

Fig. 7. Pyroxene. Prim. form. *Oblique Rhombic Prism.* P on $\hat{P}$ = 101° 5′. $\hat{P}$ on $\bar{P}$ = 87° 42′.

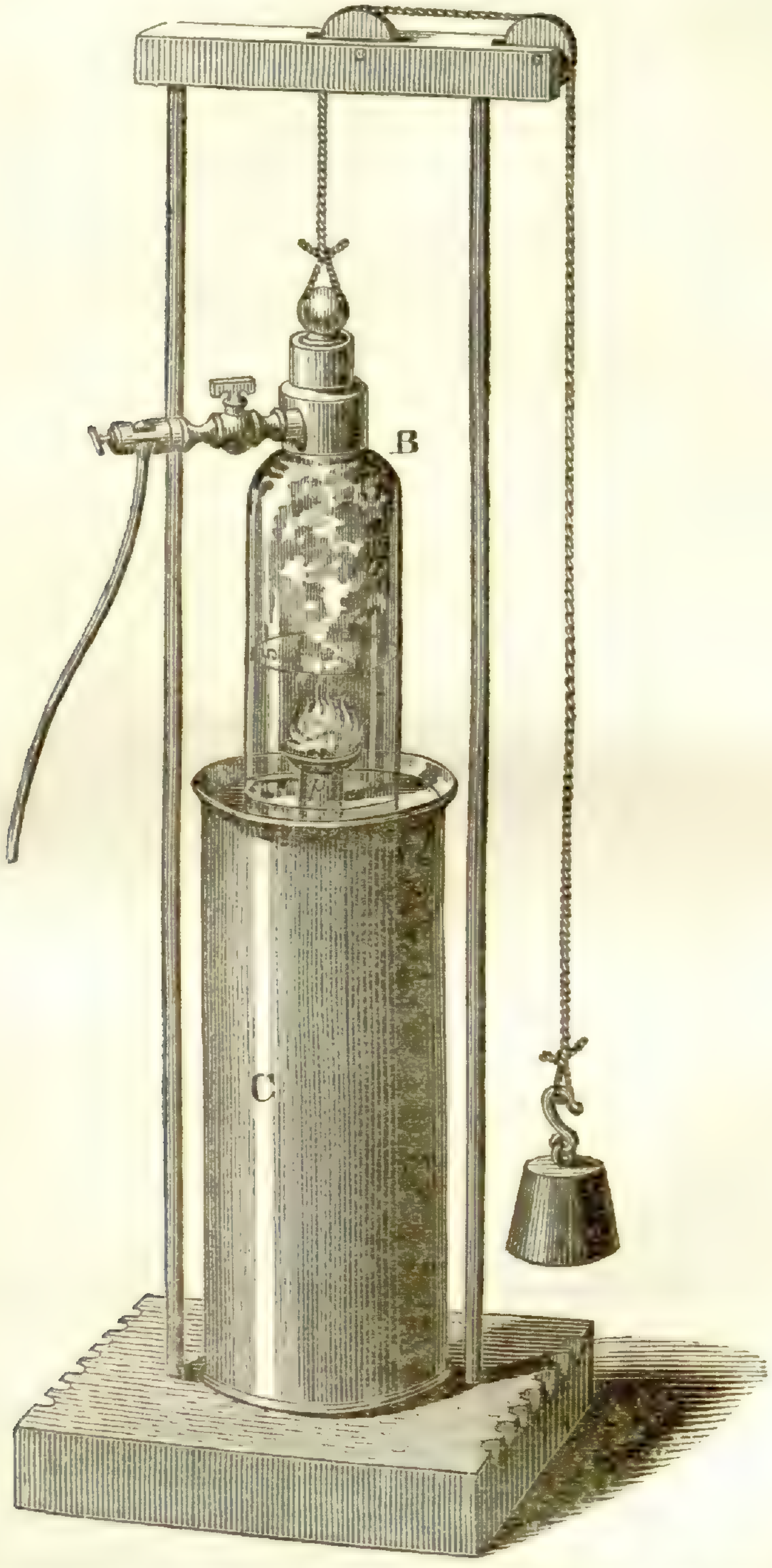
Description. $\hat{P}$ e *e* P a $\underset{\frown}{a}^3$ $\widehat{a}$ $\widehat{a}^3$.

Haüy's. M ^{1}H^1 ^{1}G^1 P A ^{3}A^3 E^1 ^{1}E ^{3}E.

e	=	133° 51′	$\underset{\frown}{a}^3$	=	144° 25′
e	=	136° 9′	$\widehat{a}$	=	150°
a	=	147° 48′	$\widehat{a}^3$	=	137° 7′

This figure represents the crystal inverted, the dominant solid angle, being the *inferior* one in front. If placed in position, the planes whose symbols have an inverted curve below, would be situated on either of the inferior lateral solid angles, and would incline on the front faces. But their symbols are the same as those of the planes, diagonally opposite. These incline on a *posterior* face. The inverted dash is therefore used according to the law already laid down.

ART. IX.—*Apparatus for obtaining the Nitrogen from Atmospheric Air;* By R. HARE, Prof. of Chemistry in the University of Pennsylvania, &c.



THIS apparatus in its principal parts, differs not from common gasometers. It is provided with a pipe, concentric with the axis of the lower vessel, surmounted by a small copper cup. The pipe in

question descends perpendicularly from the level of the brim of the vessel to the bottom; being soldered into a hole in the latter, so that the bore being accessible from without, the copper cup at the upper end may, when necessary, be touched by a hot iron introduced through the pipe.

The inner vessel of the gasometer consists of a bell glass, B, suspended by a cord passing over a wooden gallows, with suitable pulleys. The bell has a perforated neck cemented into a brass cap furnished with a female screw for receiving a cock. To this cock a flexible lead pipe is attached by a gallows screw. Under the copper cup, a sufficient quantity of phosphorus being placed, and the lower vessel adequately supplied with water, the bell glass is suspended within the lower vessel, as usual with gasometers, and allowed to descend about a third of its depth. Meanwhile the cock of the tube being open, the air is allowed to escape, so that the liquid within and without the bell glass may be on a level. The cock being in the next place closed, and the phosphorus ignited by means of a hot iron, a brilliant combustion ensues. As soon as it declines, the iron meanwhile kept in the fire should be again introduced in order to sustain the combustion till all the oxygen is absorbed.

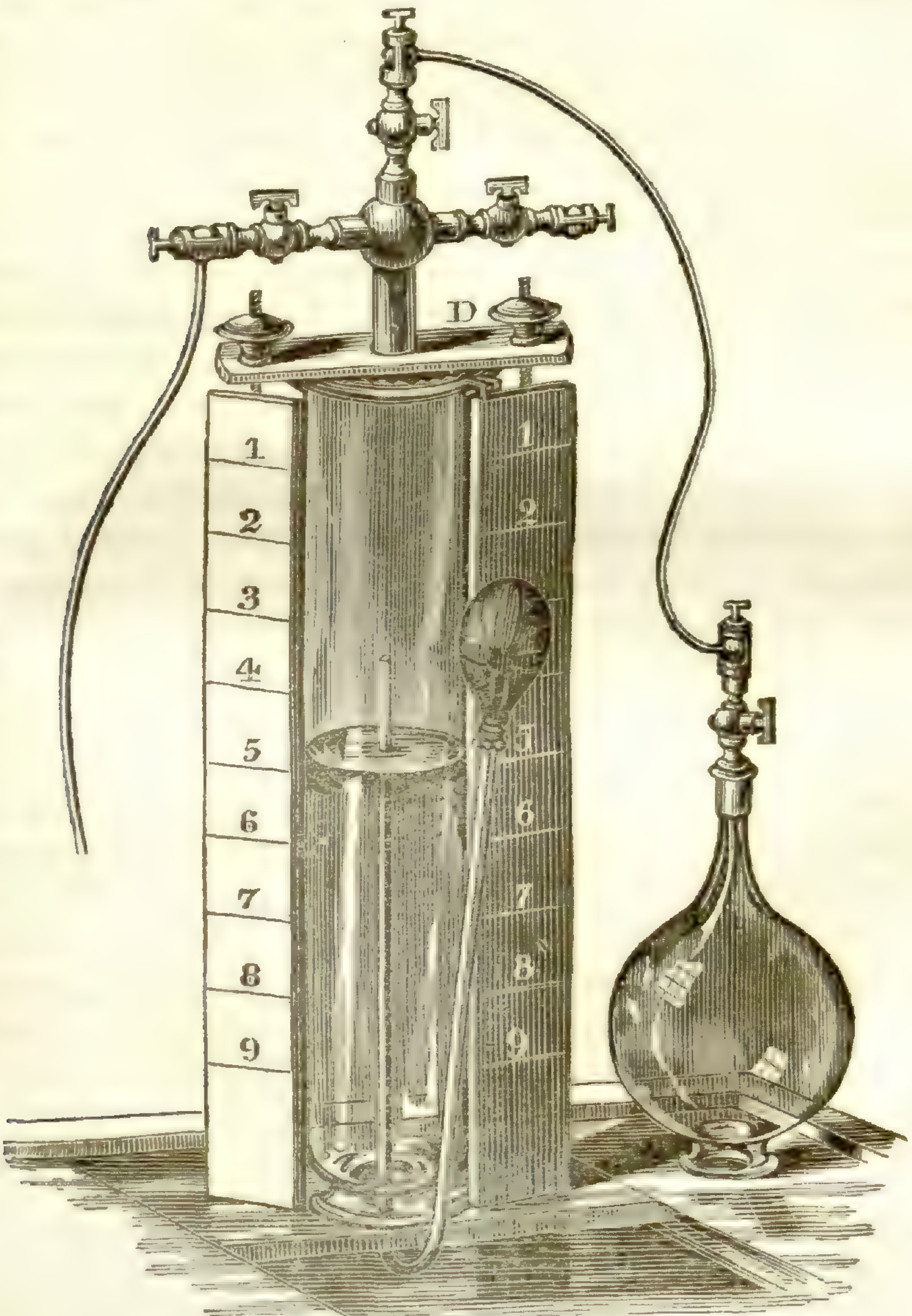
When the air in the bell glass is completely deoxygenated, which may be known by the yellow color of the fumes, by depressing the bell in the water, the residual nitrogen may be expelled into any recipient at pleasure, through the flexible pipe attached to the cock for that purpose.

ART. X.—*Large Volumescope, for the Analysis of Atmospheric Air, by means of Nitric Oxide;* by ROBERT HARE, M. D., Prof. of Chemistry in the University of Pennsylvania.

This apparatus illustrates copiously the condensation which ensues when nitric oxide gas and atmospheric air are mingled in due proportion.

The hollow glass cylinder, which constitutes the main body of the instrument, is four and a half inches in diameter, and thirty in height. It is situated over one of the three wells in my pneumatic cistern; being secured between two iron rods well fastened to the shelf below; and terminating above in screws furnished with nuts. By means of these screws, and an intervening bar of iron, a brass disk, by which

the upper orifice of the cylinder is closed, is pressed upon the rim of that orifice, so as to make with it an air tight juncture. From a hole in the center of the brass disk, a stout tube of brass proceeds, terminating in three cocks, furnished with gallows screws, so as to permit of the attachment of three flexible leaden tubes. Of these, one communicates with an air pump, another is attached to a pear shaped glass receiver, which (for want of a better name) I shall call a volumeter, as it serves conveniently, and accurately, to measure gas into precisely equal volumes.



On each side of the cylinder, there is a strip of wood, which being covered with white paper, is made to receive graduating lines in the following way. The cylinder having been filled with water, the lines are so applied as to indicate the changes of the level successively produced in the surface of the water within the cylinder, by the successive introduction of equal volumes of air. These graduations are so proportioned, as to render the portion of the cavity comprised within three of them equivalent in content, to one measure of the volumeter already described. In all there are nine graduations.

In operating with this instrument, I commence by exhausting the air from the cylinder, and thus causing the water of the pneumatic cistern, over which it is situated, to rise to the fifth graduation. The volumeter may be filled at the same time, if the cocks between it and the cylinder be opened. Care must be taken to close them as soon as the water reaches the apex, so as to prevent the lead tube from being obstructed by water. The valumeter should, in the next place, be filled with nitric oxide gas. The apparatus thus prepared, it is only necessary to open the cocks, between the volumeter and the cylinder, in order to cause the nitric oxide to pass from the one to the other. Copious red fumes of nitrous acid immediately appear. By means of the gum elastic bag, and recurved tube, jets of water are next to be thrown up into the mixture, by which the absorption of the fumes is promoted. When these have all been absorbed, there will appear to have been a condensation of about three volumes and a fifth, so that the water will have risen a little above the point to which it has been supposed to be raised agreeably to the premises.

For the satisfaction of the spectators, the accuracy of the graduation may be proved by allowing the contents of the volumeter in atmospheric air to pass in three times, showing that the water is thereby depressed to 3rd, 6th, and 9th graduations. Also, by adding the contents of the volumeter containing three of the volumes indicated by the scale, to five previously introduced; thus, showing that the aggregate will be eight volumes, instead of less than five, as when three of nitric oxide are admitted to five of air.

Art. XI.—*On the Excrementitious matter thrown off by Plants*; by J. Buel.

I have read, with much interest, the opinions lately advanced by De Candolle, Macaise, and I believe by Professor Lindley, in regard to the excretory powers of plants. I fully acquiesce in the statement that plants throw off, into the soil, excrementious matters, not congenial to their wants; but I cannot accede to the other part of their theory, viz.—that these matters are poisonous to the species which gives them off, and that from this cause arises the necessity of an alternation in farm crops. I will briefly state my reasons for this dissent, and shall be happy to be corrected by any of your correspondents, if I am in the wrong.

I venture to assert, in the first place, that in forests and uncultivated grounds, the same plants, annuals as well as perrenials, are found growing in successive years, without apparent deterioration, *if the plants are permitted to remain and decay where they grow.* It is not what *grows upon* the ground, but the crop which is *carried off*, that impoverishes the soil. We find an additional illustration of this truth, upon waste ground around farm buildings, where we often see the bur dock, nettle, hemp and other plants, grow up fall and decay, for years, and each successive growth increases, rather than diminishes in vigor.

American husbandry furnishes facts no less apposite to my arguments. In a large section of Western New York, comprising a district of sixty, or more, miles square, it is a very common practice to grow wheat, in the same field, for successive years. On a recent visit to that district, I put the question to an intelligent circle of gentlemen, "how many years in succession has wheat been grown upon any of your lands?" One case was cited where it had been grown 21 or 22 years. A gentleman then alluded to a neighbor, who had grown wheat 22 years without intermission, on one field, and the fact was accredited and confirmed by others. "And what, I asked, was the product of the last season?" "Forty bushels to the acre," was the answer. "Was manure applied?" "No."

In another district of the State, comprising the south towns of Erie and Chautauque Counties, oats constitute a favorite crop; and they are grown many successive years on the same ground, without diminution of product.

In some districts of Ohio, Indian corn has been planted on the same ground, almost from the first settlement of the country. A respectable gentleman who resides on the banks of the Sciota, at Portsmouth, writes as follows. "My farm is immediately at the mouth of the Sciota River. It is rich bottom land. The soil is loam, finely proportioned, with clay and sand, formed by successive depositions from the Ohio and Sciota Rivers, which inundate it every year. I do not think there is much difference in the quality of the soil for the depth of 15 or 20 feet. *Many fields have been cultivated in corn for* 20 *or* 30 *years in succession*, and I doubt whether a cart load of manure was ever used in the place, before I became in possession of it."

The preceding facts, and similar ones, which might be stated, amply disprove in my mind, the theory attempted to be established, that the excrementitious matter of plants is poisonous. The necessity, in good husbandry, of alternating farm crops, arises, I think from the facts, generally conceded, that plants do not take take up, or retain the same food; that each species takes something specific which others do not take; and that in ordinary soils there is not enough, of this specific food to maintain successive crops without deterioration. The cases which I have cited refer not to ordinary, but to extraordinary soils, which form exceptions to a general rule. These are so abundant in the specific food of the wheat, the oats and the corn, that years of successive cropping, have not exhausted, nor sensibly impaired the supply.

Albany, Feb. 18th, 1835.

ART. XII.—*Notice of an easy method of filling long Syphon tubes, in a Note addressed (by request) to the Editor*; by WILLIAM FOSTER, Esq.*

New Haven, Nov. 26, 1834.

Sir,—Agreeably to your request, at the conclusion of your very interesting lecture, I will now put on paper a brief statement of the application of the syphon upon a large scale, for the purpose of drawing water from distant places. This application may not be new; but I do not remember to have seen it in this, or any other

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* We trust that Mr. Foster will pardon the publication of this letter, since it is of a very useful character.

country, before I tried the experiment. The ancients, we know, brought water for the supply of their cities, by means of costly acqueducts, over hills and vallies, without ever using the fountain principle.

About twenty years ago, I suggested to some gentlemen in Boston the feasibility of conducting water from one good well to dry reservoirs in the neighborhood, in consequence of hearing that certain wells in the city had copious springs of good water, which became bad for want of sufficient use. The idea of carrying water through a syphon several hundred feet in length, and drawing water from one well into another, was discussed by these gentlemen, and treated with ridicule. But some years after, Mr. Chapman, proprietor of a distillery in Charlestown, requested me to describe the process; and with that instruction he employed a Plumber to lay a leaden tube of three quarter inch bore, from a well twenty five feet deep, several hundred feet distant from the well of his distillery, which was about thirty feet deep, and where he wanted a greater supply of water.

The operation failed. He then came to me, and told me that I had led him into an expensive error. I told him that had he communicated to me his intentions, I would with great pleasure have superintended the work; but now, not knowing what defects there might be in the tube, I could not answer for his success. However, I consented to assist him, but my first essay was unsuccessful.

I need not inform you Sir, as to the principles of the syphon, or that its power to overcome an eminence is limited to about thirty two feet, answering to the column of water which the pressure of the atmosphere can raise; or that any defect in the syphon, or any air confined in it, would be fatal to its operation. The usual mode of charging a syphon, you know, is by exhausting it partially by inspiration at the longer end. But this was not possible with a tube several hundred feet long, and the expense of a Pneumatic apparatus, to procure a vacuum, would have been too great; therefore, I had determined to put it in operation by filling it with water, both ends being stopped: this was done by a small branch at the summit of the tube; and when filled, this branch was well corked, and the cork pressed down hard on the water, so as to exclude all the air at the surface. It was to be apprehended that some undulations might exist in the horizontal part of the tube, and afford a receptacle for air, which would there be confined without a possibility of escaping, and also prove fatal to the success of the experiment; but of this I could know nothing, as I had not seen the tube laid.

In this state of uncertainty, I began the operation and filled the Syphon; but, as I said before, it failed. On the second trial, I observed that when the syphon was full, the water in the filling branch rose and fell alternately, and so much, that as water has but little elasticity, I concluded that there was air in the tube, and it was therefore emptied. Then, to charge it anew, and at the same time to exclude the air, it was proposed to perforate the lower end of the long branch, at the bottom of the receiving well with a fork, just above the cork which closed it. These small holes allowed the air to escape as it was driven before the water, without losing enough water to prevent the filling the tube with ease. Thus was the air excluded, and the syphon put into operation, and continued for a long time, with some occasional obstruction, arising from the smallness of the tube, and the want of water at the source.

I should suppose that there were many situations, where water might be brought from one valley to another, over any hill not exceeding thirty two feet, or which could without too much expense, be reduced to that point, for the purposes of irrigation, or manufacturing. Large quantities of water as well as small, may be raised by means of iron mains of large dimensions; and the cutting down hills to procure levels, or surrounding them, and thus increasing the length of acqueducts, at a great expense; and loss of water by percolation and evaporation may be avoided. Mountain swamps may be drained, or any swamps, where a lower level is not too far distant for the place of issue, or even in a level country, provided some vein of loose gravel can be found into which a place of discharge may be dug below the surface of the swamp. The ingenuity of our countrymen, will, I am confident, yet find many other useful purposes to which the principle may be applied.

P. S. Have you any knowledge of the process whereby the Chinese convert rice into a substance resembling pearl? If it were not expensive many useful articles might be made of it.

Art. XIII.—*Caricography;* by Prof. C. Dewey.

Appendix, continued from Vol. xxvii, page 342.

Carices of the Northern regions of America.

On the return of Dr. J. Torrey, one of the most active members of the New York Lyceum, from England the last year, he brought

a large collection of grasses. They were put into his hands by that distinguished botanist, Hooker, for examination; and had been collected in the voyages and tours of discovery in Arctic America. Dr. Torrey was so good as to put into my hands the specimens of the *Carices*, amounting to collections from about *one hundred and ninety* different places in those regions, and embracing with several new and rare ones, most of the new species already described, and several of those long known in the United States. The plants are very interesting, as exhibiting the vegetation of those Northern regions. Few of them are diminutive in size, but the species common in this part of the country attain about the same size in that, and come to maturity at the same time. Thus we find specimens in a mature state in June on the shores of the Arctic ocean, and in May at Fort Vancouver. Some of these Carices have already been described in the last two articles on Caricography, and the rest will be given in a future number. At present, I propose to give a catalogue of all those received, with their localities, and such brief remarks as seem necessary. In the first place, however, I make my acknowledgments to Dr. Torrey for his liberality. May success still attend his efforts in the cause of Natural Science.

List of Carices, collected in the Northern parts of America.

C. *dioica*, L.—Rocky Monntains, Norway House, Cumberland House, and sea coast of Arctic Regions. Many and fine specimens.

*C. *Davalliana*, Smith. Rocky Mts. Several specimens, fine, large, and so far removed from the preceding as to justify Smith in making it a new species; not before found in America.

C. *scirpoidea*, Mx. In many parts of the Rocky Mts. I feel unwilling to take this species from Mx., and call it after that Danish name, C. *Wormskioldiana* of Horneman. The specimens are many, fine, beautiful; dioecious or androgynous with stamens only at the summit of the spikes; leaves deep green, broad, flat, grassy.

*C. *capitata*, L. Rocky Mts. and Hudson's Bay. Large and fine specimens. This species and the following, not before credited to our country, but very common in the north of Europe.

*C. *incurva*, Lightfoot. Rocky Mts. This is a small, distinct, and handsome species.

C. *sterilis*, Willd. Carlton House and Rocky Mts.

C. *bromoides*, Schk. Rocky Mts., Cumberland House, and Carlton House.

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* Those marked with a * not before credited to America.

C. *rosea*, Schk. Lake Winnipeg, and Carlton House.

C. *stipata*, Muh. Norway House.

C. *multiflora*, Muh. Canada and Cumberland House. Large and excellent.

*C. *chordorrhiza*, L. Columbia River. Exactly the European, but not before found in our country.

*C. *stenophylla*, Wahl. Rocky Mts. and Carlton House. This is a small species with androgynous spikes which are staminate at the apex. It is a well characterized species, now first found in America.

C. *teretiuscula*, Gooden. Rocky Mts., Norway House and Cumberland House. These are mostly small, but distinct specimens.

C. *Muhlenbergii*, Schk. Hudson's Bay. A fine large specimen.

C. *disperma*, Dewey. Norway House, Rocky Mts. and Cumberland House. Many specimens, some small, and some of the size found in the northern States.

C. *Deweyana*, Schw. Rocky Mts. Canada, Cumberland House, and Carlton House. There were many and large specimens, exactly like those of the northern States.

C. *trisperma*, Dewey. Rocky Mts. fine and large. This has been supposed to be the following, but the present specimens settle the matter against such a supposition.

C. *loliacea*, L. Cumberland House. This is also C. *gracilis*, and C. *tenella*, as well as C. *loliacea*, in Schk. It greatly resembles C. *disperma*, but the fertile flowers are differently situated, being in C. *loliacea* at the base of the spikelets, as on C. *trisperma*. But the fruit is shorter and rounder and more obtuse than on C. *disperma*, and *far more so* than on C. *trisperma*. One can scarcely see this plant without being convinced of its being identical with that described in Schk. I have not before seen one that belonged to this species in our country.

C. *scoparia*, Schk. Carlton House and L. Winnipeg.

*C. *leporina*, L. Rocky Mts. and Norway House. This is the C. *ovalis* of Gooden., and the C. *leporina* found in Sweden and Norway. It has not before been brought to light here; although credited by Mx. and Ph., who doubtless intended the preceding. No one however can compare these species with those from Sweden, without feeling confident that the true C. *leporina* of Lin. has at length been found in the Northern regions of America.

C. *straminea*, Willd. } The latter found at Lake Winnipeg, and
and its var. *minor*, D. } both at Cumberland House.

C. *cristata*, Schw. Lake Winnipeg and Cumberland House. They are chiefly of the smaller varieties, found with the larger over the northern States.

C. *scirpoides*, Schk. Lake Winnipeg, Rocky Mts. and Norway House. Fine and large as in this latitude.

C. *curta*, Gooden. Rocky Mts. This is the variety with smaller and less silvery-like spikelets, tall as in the northern States.

C. *festucacea*, Schk. Cumberland House.

C. *tenera*, Dewey. Lake Winipeg. This is just like those found here.

*C. *tenuiflora*, Wahl. Canada and Cumberland House. An old European species found in Lapland, now found in northern America.

C. *siccata*, Dewey. Columbia River and Cumberland House.

C. *aurea*, Nuttall. Carlton House, Cumberland House, Rocky Mts. and Lake Winnipeg. A great many specimens, some large, and some only an inch or two high, but very well characterized.

C. *concolor*, R. Br. Norway House and Lake Winnipeg. Fine and several specimens of this new species of R. Brown.

C. *mutica*, R. Br. Near Fort Franklin on M'Kenzies' River. Only a specimen or two of this species.

C. *saxatilis*, L. Bear Lake and sea coast in the Arctic Regions. This species of which I have not before seen any specimens from our continent, is well characterized and described.

C. *compacta*, R. Br. Rocky Mts. and Fort Franklin on M'Kenzies River. This much resembles the preceding, but is considerably unlike it also. Vol. XXVII, p. 237, Tab. V, fig. 63.

C. *acuta*, L. Columbia River. var. *sparsiflora*, D. Fort Hope.

C. *cespitosa*, L. Rocky Mts. Just like ours.

C. *aquatilis*, Wahl. Bear Lake. Large and fine.

C. *crinita*, Lam. Norway House and Hudson's Bay. Large as often found here.

C. *Carltonia*, Dewey in Vol. XXVII, p. 238, Tab. V, fig. 64.

C. *arctica*, Dewey. " " 239, " " 66.

C. *affinis*, R. Br. Carlton House. Fine.

C. *attenuata*, R. Br. Do. Distinct species.

C. *ovata*, Rudge. Rocky Mts. This species is sixteen to twenty four inches high, with large ovate, pendulous spikes, staminate above.

Rudge credited this plant to Newfoundland, but it has not been found till it was discovered by the late explorers of the northern regions of America. It is a distinct and beautiful species.

C. *ursina*, Dewey in Vol. XXVII, p. 240, Tab. V, fig. 68.

C. *Willdenowii*, Schk. Lake Winnipeg, Carlton House, Rocky Mts. and Cumberland House. Many specimens, rather small, but good, and well characterized.

C. *pedunculata*, Muh. Rocky Mts. and Cumberland House. Good specimens.

C. *atrata*, L. Rocky Mts. Good.

C. *Buxbaumii*, Wahl. Rocky Mts., Lake Winnipeg, Cumberland House, and Observation Inlet. Many, large and fine specimens.

*C. *Vahlii*, Schk. Rocky Mts., Sea coast of Arctic America. Beautiful specimens, and exactly like the European.

C. *gracillima*, Schw. Norway House. Large and fine specimens.

C. *misandra*, R. Br. Sea coast of Arctic America.

*C. *Schkuhrii*, Willd. Lake Winnipeg. This seems to be the same plant, which was found at the Caspian Sea, and described by Willd., and said to resemble the following.

*C. *supina*, Willd. Bear Lake. This species is found in the rocky woods of Germany and Austria.

C. *varia*, Muh. Norway House and Cumberland House. Several varieties of this varying species.

C. *Richardsonii*, R. Br. Rocky Mts. Norway House and Cumberland House. This is a fine species and very distinct.

C. *ornithopoda*, Willd. McKenzie's River. This is exactly like the European species.

C. *concinna*, R. Br. Carlton House, Rocky Mts. and Cumberland House. This, considered a new species by R. Br., is so like the preceding, that they cannot be separated. Indeed the description of R. Br. is almost precisely that of this species in Schk.

C. *Oakesiana*, Dewey. } Bear Lake, Canada and Norway House.
C. *oligosperma*, Mx. } This species is found to be widely spread over the country.

C. *Oederi*, Ekrh. Canada. Exactly the same that I gathered in Canada, near the Falls of Niagara.

C. *folliculata*, L. Norway House. Fine.

C. *attenuata*, R. Br. Carlton House. A beautiful species.

C. *plantaginea*, Lam. Cumberland House. This is the real plant.

C. *anceps*, Schk. Rocky Mts. and Carlton House. Several specimens.

C. *Parryana*, Dewey, in Vol. xxvii, p. 239, Tab. V. fig. 65.

C. *alba*, var. *setifolia*, D. Rocky Mts. This is C. *paupercula*, Mx. Many and good specimens.

C. *pallescens*, L. Carlton House. Good and large.

C. *capillaris*, L. Rocky Mts., Fort Norman and Cumberland House. Excellent.

C. *podocarpa*, R. Br. Rocky Mts.

C. *flexuosa*, Schk. Norway House.

C. *sylvatica*, Huds. Canada.

C. *Grayana*, Dewey. Rocky Mts. and Hudson's Bay. Fine specimens, exactly like those found by Dr. Gray in the State of New York.

C. *umbellata*, Schk. Rocky Mts., Norway, var. *vicina*, D. Norway House, L. Winnipeg. Many specimens of both varieties.

C. *limosa*, L. Hudson's Bay, Norway House, Rocky Mts. and Cumberland House. Just like the common species.

*C. *laxa*, Wahl. Rocky Mts. and Norway House. This resembles the preceding, but is made a distinct species by the most distinguished Caricographers. It is found in Europe, in the marshes of Lapland.

C. *pseudo-cyperus*, L. Cumberland House. Just like ours—common.

C. *trichocarpa*, Muh. Cumberland House.

C. *aristata*, R. Br. McKenzie's River and Cumberland House. This is a fine, large, distinct species. Vol. xxvii, p. 240, Tab. V. fig. 67.

C. *filiformis*, Gooden. Cumberland House. Large and beautiful.

C. *pellita*, Muh. Cumberland House, Bear Lake, Carlton House, and Lake Winnipeg. Many and fine specimens.

C. *ampullacea*, Gooden. Bear Lake.

C. *vesicaria*, L. Rocky Mts.

var. *cylindracea*, Schw. Cumberland House.

C. *retrorsa*, Schw. Rocky Mts. and Norway House.

C. *longirostris*, Torrey. Rocky Mts. and Carlton house. Large and distinct.

Several new species, found in the Arctic Regions, will be described in another number of this Journal.

Note.—Although most of the Carices described by Michaux, have been satisfactorily ascertained, I am permitted to give the result of

an examination of the plants themselves. This was made by Dr. J. Torrey, also, on his visit at Paris, when he obtained access to the plants in the Herbarium of Michaux.

Names by Mx.

C. *microstachya* is C. *polytrichoides*, Muh.
— *typhina* " — *squarrosa*, L.
— *vulpinoidea* " — *stipata*, Muh.
— *leporina* " — *scoparia*, Schk.
— *Richardi* " — *curta*, Gooden.
— *triceps* " — *hirsuta*. Willd.
— *viridula* appears to be a var. of C. *Oederi*, Ehrh.
— *scirpoidea* is C. *Wormskioldiana*, Hor.
— *flava* " — *flava*, L.
— *Oederi* " — *Oederi*, Ehrh.
— *folliculata* " — *folliculata*, L.
— *debilis* " — *flexuosa*, Schk.
— *lenticularis* " — *stricta*, Gooden.
— *paupercula* " — *alba*, var. *setifolia*, D.
— *striatula* " — *blanda*, D.
— *rostrata* is the small var. C. *Xanthophysa*.
— *subulata* is C. *Collinsii*, Nutt.
— *plantaginea* " — *plantaginea*, and C. *anceps*. His description embraces both species.
— *miliaris* seems to be new.
— *oligosperma* is C. *Oakesiana*, D.
— *striata*, specimens imperfect, C. *filiformis*? Gooden.
— *lanuginosa* is C. *pellita*, Muh.

ART. XIV.—*Notice of the fossil teeth of Fishes of the United States, the discovery of the Galt in Alabama, and a proposed division of the American Cretaceous Group*; by SAMUEL GEORGE MORTON, M. D.

SINCE the publication of my "Synopsis of the Organic Remains of the Cretaceous Group of the United States," I have obtained some additional facts in reference to this portion of our Geology, and lose no time in placing them at your disposal.

A letter from our distinguished friend G. Mantell, Esq., informs me that my plates of the fossil teeth of Fishes, &c. from the marl of this country, had been carefully examined by M. Agassiz, who thinks he has identified among them the following species:

Carcharias canceolatus, (Pl. XII, fig. 3 and 5.*)
——— megalotis, (Pl. XII, fig. 4.)
——— polygurus, (Pl. XII, fig. 2.)
Galeus pristodontus, (Pl. XI, fig. 6.)
Lamna acuminata, (Pl. XI, fig. 11.)
——— Mantelli, (Pl. XI, fig. 4.)
——— lanceolata, (Pl. XI, fig. 5.)
——— plicata, (Pl. XI, fig. 2 and 3.)

All these species are found in Europe; and three of them, viz. Galeus pristodontus, Lamna acuminata and L. Mantelli, have been obtained by Mr. Mantell, in the Chalk of Lewes in Sussex, England. Nor does the analogy stop here; for the same chalk contains the Saurocephalus lanciformis and S. Leanus of the United States! But Mr. Mantell adds that the latter two are not Saurians, as their discoverers supposed, but *fishes*.

Again, Mr. Conrad discovered at Erie, Alabama, a thin stratum of a strongly argillaceous clay, in every respect resembling the *Galt* of England. You will recollect that the English Galt is embraced in the ferriginous sand, and that its characteristic fossil is the *Inoceramus sulcatus*. The mineralogical characters of the Galt of Alabama are the same as those of the European variety; it is also immediately connected with the green sand, and moreover contains a species of *Inoceramus*. The specific characters of the latter are scarcely available from the solitary cast in my possession, (which is imbedded in the Galt) but it is obviously different from the I. sulcatus. Thus every day unfolds new analogies between the cretaceous deposits of Europe and America.

I take this occasion to remark, that I think our cretaceous strata may be safely referred to three divisions, of different ages, viz. the *upper*, the *medial*, and the *lower*. The *upper division* has been particularly and exclusively examined by Mr. Conrad, who observed it near Monk's corner, thirty miles north of Charleston, S. C. and extending thence to near Charleston, and north to Vance's ferry. Its characteristic fossils appear to be Pecten membranosus, Terebratula lacryma, Ostrea cretacea, O. panda, and Echinus infulatus. This division is also admirably exposed in many parts of West Florida, and the southern section of Alabama, embracing the Nummulite Limestone from Claiborne to St. Stephens. Its characteristic fossils in

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* The references are given for the convenience of persons who possess the Synopsis, as no attempt was made in the latter to identify more than one or two species of the many teeth of fishes there figured.

Alabama are the Plagiostoma dumosum, Pecten perplanus, P. Poulsoni, Nummulites Mantelli, and Scutella Rogersi. The limestone of the upper division is very light colored and porous, sometimes friable, in other instances more compact.

The *Medial division* is chiefly recognised in Gloucester and Burlington counties, New Jersey, and near Wilmington, N. C. It is often of a straw yellow color, hard, compact, and either subcristalline or granular, or even friable. Its characteristic fossils are Spatangus parastatus, Ananchytes fimbriatus, A. cinctus, Nucleolites crucifer, Belemnites? ambiguus, Scalaria annulata, and Cidarites diatretum.

The *Lower division*, or green or ferruginous sand, is too familiar to need any additional comment, often underlying the other divisions, and often again entirely denuded and exposed. Stretching from New Jersey in the form of a crescent through the southern States, it is readily traced into Arkansaw and Missouri, and is every where characterized by fossils described and figured in my Synopsis.

I have thought the above facts might interest those of your readers who live in the vicinity of the fossil strata, which are well worthy of their patient research.

Art. XV.—*Remarks on the Retina*; by W. C. Wallace, M. D. Surgeon to the N. Y. Institution for the Blind.

It is stated by some of the older anatomists that the retina is of a fibrous texture, yet no mention is made of the manner by which the fibres may be exhibited. By modern authors it is asserted to be a mere pulpy mass without fibres.

That the retinæ of fishes possess a fibrous appearance is stated by Cuvier. The fibres may be seen in the skate, like floss silk, radiating in a beautiful manner from the entrance of the optic nerve to the ciliary body. After a short immersion in alcohol, they are very conspicuous in the streaked bass, the cod, the halibut, and the poigee. Exterior to the fibres there is a layer of pulpy matter.

After the eye of an ox is immersed for a day in alcohol, the anterior portion and the vitreous humor then removed, and a solution of corrosive sublimate poured into the cup that remains, by separation with a hair pencil the fibres may be demonstrated, radiating from the optic nerve to the ciliary body. The central artery and vein of the retina dividing into branches may be seen above the fibres, but by this dissection there is no appearance of membrane connecting the

ramifications. Immediately under the fibres there is a layer of pulp thinner than that of fishes.

(When the sclerotic and choroide coats are removed, a little alcohol poured on the exposed retina, and the preparation immersed for some hours in water, the membrane of Jacob is seen floating in the manner in which it is usually described. Beneath this, a cobweb-like membrane of considerable tenacity may be brushed off with a hair pencil. When this preparation is allowed to putrefy and the retina carefully washed away with a soft brush, the vascular coat remains over the vitreous humor and may be easily separated from it. Its numerous vessels ramify and anastamose with each other in the delicate membrane like the veins in a leaf.)

In birds, the optic nerve before dividing, forms a line on each side of the marsupium, from which the fibres originate.

In man, the fibres of the retina on the side towards the nose, radiate as in the ox. On the outer side some proceed no farther than the central foramen; others pass beyond it, and after making a curve return and converge at the center, so that this point is surrounded by the extremities of fibres.* The layer of pulp around it is thicker than in any other part of the retina.

This disposition of the fibres explains why there is a fold in the retina after death. It will naturally project at the weakest point when collapsed by the transudation of the humors.

The rays of light falling upon the fibres and impelling them against their pulpy bed seem to be the cause of vision. This may be proved by an experiment related by Sir Charles Bell. "Close the eyelids and cover them with a piece of black cloth or paper that has a small hole in it, and place this hole, not opposite to the pupil but to the white of the eye; direct a beam of light upon the hole, and a person will see this light in its true direction." In this experiment the light falls upon two parts of the retina. The same or a greater impulse is given to the fibres first struck, but there is not a double impression because the fibres impinge against the vascular membrane and not against the pulp.

The sense of touch is keenest at the termination of the nervous fibres at the points of the fingers, and that of taste at their termination at the papillæ of the tongue. The sense of sight is also more acute at the termination of the fibres at the central foramen.

The central foramen appears to be formed for the purpose of enabling those animals that possess it to view very minute objects.

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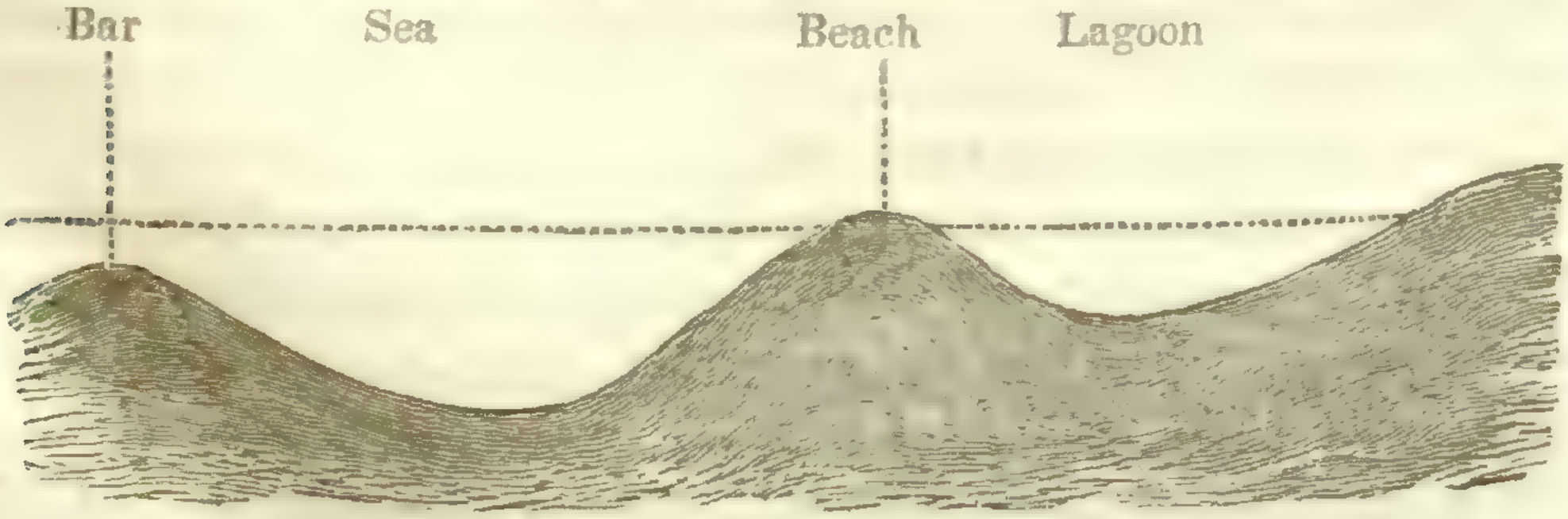
* The fibres are best seen in young animals.

Art. XVI.—*Observations on the Tertiary Strata of the Atlantic Coast;* by T. A. Conrad.

The new Pliocene formation, or that deposit which is characterized by recent species of shells, in many places contains nothing more than beds of the common oyster shell, resting immediately on the older Pliocene marls. It seems certain therefore that the convulsion which upheaved the latter had been insufficient to raise them to the level of the ocean; but if sand bars existed then, as was doubtless the case, the ancient margin of the sea would, by the protrusion of these bars above water, be converted into a chain of lagoons, such as line the coast at the present day. Here then, the oysters of the newer Pliocene or last tertiary era, would find suitable conditions to multiply, until they were in their turn upraised above the level of the sea. If we are inclined to adopt this theory, we should carefully examine whether any fragments of marine shells can be detected among the beds of *Ostrea*, to indicate that the sea beach of that era existed as a boundary of the supposed lagoons; for in many places the level of the beach would doubtless have been such as to permit it to be entirely submerged by the waves of a tempestuous sea. I find ample proof of this in the deposits at Easton in Maryland, where among the oyster shells which are entire, fragments of *Pecten madisonious* an extinct species, are abundant. This is an interesting example, for the upper bed of the strata beneath is composed almost entirely of the *Pecten Madisonius*. This bed therefore, in the newer Pliocene era was the only one which could be disturbed by the surf, and the shells first broken on the sands of the beach were afterwards swept into the lagoon and deposited on the bottom. To explain the phenomena which would be observed after a slight elevation of our coast at the present day, the following diagram is annexed.



An upheave sufficient to elevate the bar above the surface of the ocean would convert what is now sea into a lagoon, and the lagoon into dry land. The latter would become a deposit of fossil oyster shells, and the newly formed lagoon would gradually be peopled with the same oyster should the species be preserved. These tertiary deposits are, even now, the substrata of the ocean bed along the coast, but the mud and sand have accumulated to such a depth, that the fossils are seldom washed up by the surf. It does, however, occasionally happen that they are cast ashore, much to the surprise of the inexperienced conchologist. I have found specimens of the Rangia cyrenoides, exceedingly water worn on the coast of Virginia, and this shell does not inhabit the open sea, and is at present confined to the estuaries of the Gulf of Mexico. Professor Ravenel, of Charleston, an excellent conchologist, has a specimen of *Venus alveata*, (nobis) an extinct species, which was found on the sea beach of Sullivan's island, washed up doubtless by the waves.

As the Ostrea virginiana originated in the Miocene era, it may be that the fragments of Pecten Madisonius at Easton, were recent exuviæ, and that every tertiary deposit above the Eocene contained in the shallow and tranquil waters, beds of living oysters. It may also have happened that sand bars increased in elevation during the lapse of ages, until in places, the intermediate waters were protected from the sea, and thus strata of oceanic shells would be formed, capped by the beds of oysters; both, in that case, were probably raised to their present elevation by a single upheave.

In the newer Pliocene of the Potomac river we find a deposit of such shells as now live both in the open sea, and in the harbors of Newport, New York, and Charleston. The *Pholas costata* is there imbedded entire in the clay, in precisely the same manner as the living shell burrows,* but when the oysters made their appearance, these oceanic shells no longer inhabited this particular locality, and it is obvious that some cause had rendered it unfit for their peculiar habits; with the appearance of the oysters, the clay was no longer deposited, but sand and gravel began to be washed into the shallowing estuary. The oysters however, seem to have lived here for a short period only, for they constitute but a thin seam, and their shal-

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* The clay of the Newer Pliocene period is precisely similar to that now occurring in the sea. I have seen a specimen of the latter from the New Jersey coast full of young shells of Pholas crispata, and the same kind of clay is washed ashore from the Gulf of Mexico with specimens of Pholades imbedded in it.

low lagoon was soon filled up by transported gravel and sand. The temperature of this region then appears to have been equivalent to that of West Florida at the present day, as the *Rangia* and *Mytilus hamatus* are common associates of the fossil, just as they now are of the recent oyster shells in Florida and South Alabama.

In regard to the species varying greatly in different localities of the same geological age, it is easily explained by the facts which may be adduced in relation to the habits of recent shells. If our coast were now suddenly elevated, we should find spots where the shells would consist chiefly of an immense number of Modiola demissa mixed with Littorina littorea and Melampas bidentatus; these are found on the margin of the lagoons at high water mark, the Modiola imbedded in a tenacious soil. At a little distance would be found Venus mercenaria, Mya arenarea, Solen ensis, Solecurtus caribeus; among these would be Ostrea Virginiana, Fusus cinereus, and a few of Pecten concentricus. Such is the group existing on the sandy shore of the estuaries. Hard by, would be a vast deposit of oyster shells with Echinus, and immense masses of Serpula. These live on the bottom of the lagoons, which is composed of a mixture of sand and mud. Then would be found another group of shells which live only in deep water, the Astarte lanulata, Nucula limatula, N. proxima, Cardita borealis, Pholas costata, in company with great numbers of Mytili. This deposit we should recognize as having been formed in harbors, like those of Newport and Charleston, and the imbedding substance would be clay, and the finer materials washed by feeble currents from the rivers, which discharge their waters into these large estuaries. Then we should find the same shells mixed with a variety of other species imbedded in sand, abundantly intermixed with fragments of the same species. This would represent the bed of the ocean in the shallower parts along the coast; and then perhaps farther to the east, other species again would be discovered, which now live only in the deeper parts of the sea.

In adopting the terms given by Lyell to the European tertiary formations, we by no means imply that the American equivalents are of precisely the same age, or that they were influenced by the same convulsions. We only mean that they occupy the same relative positions, and they may have all originated through the agency of convulsions not operating beyond the limits of the continent of America and the adjacent islands.

ART. XVII.—*Notice of the Transactions of the Geological Society of France, for* 1833, *by* M. BOUE, 8vo. p. 506. By C. U. SHEPARD.

THIS very recent society, although organized for the promotion of geological science, already holds the first rank, for the number and activity of its members. We propose to give some account of the plan of its report for 1833, selecting such abstracts as appear most likely to interest American readers.

The report does not confine itself exclusively to geology, but includes notices relative to the Natural Sciences generally, Mathematics, Medicine and Statistics—so far as they have any connexion with the object of the association. It begins with an enumeration of the new societies and new publications for 1833.

NEW SOCIETIES AND PUBLICATIONS.

The Natural History Society of Paris, has undergone a transformation of some importance, and now bears the name of the *Société des Sciences Naturelles.* Its present plan is peculiarly adapted to a system of lectures and scientific conferences. Its lectures, given by the most distinguished naturalists at every hour of the day, are public and gratuitous for all students resorting to the capital for instruction. It has a section for physics and chemistry ; another for zoology and anatomy ; a third for geology and physical geography, and a fourth for anthropology.

A scientific congress, similar to the British association, although much more limited, consisting of but two hundred members, held its first meeting at Caen, under the presidency of M. GUIZOT. It consists of the following sections ; viz. general history, physical and agricultural sciences, medical sciences, history, literature and political economy. Their transactions form one volume 8vo. entitled *Congrès Scientifiques de France, Rouen,* 1833. The meeting for 1834, was to be held at Poitiers.*

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* The condition of the public libraries of Paris, is a subject of complaint. The Royal library is said to be deficient in every thing recent. That of the Institute, is not well arranged, or regulated for easy consultation, besides which the place is uncomfortable to visitors in winter, and many of the foreign journals are incomplete. The library of the School of Mines, contains a valuable collection of books and particularly those journals which are important to the geologist, a part of which, it is to be regretted, are deficient in some of their numbers. The library of the Garden of Plants, is said, on the whole, to present the greatest facilities for

The *Annales des Sciences Naturelles*, are to be henceforth divided into two compartments; one devoted to zoology and edited by MM. Audouin and Milne Edwards; the other to botany, under the direction of MM. Ad. Brongniart and Giullemin. M. J. de Fontenelle, publishes a monthly journal of the Physical and Chemical Sciences, and of the agricultural and domestic arts.

M. E. Arnoult, commenced in May, 1833, the *Journal Hebdomedaire des Académies et des Sociétés Savantes de la France et de l'étranger*, (*in* 4to.)

The *Belgic Royal Academy of Sciences*, has published at Brussels, two fine volumes of Geological Memoirs, relative to Liége. M. Dumont is author of one of these, and M. Davreux, of the other.

The Scientific Congress of German Naturalists, held their meeting for 1833 at Breslau; and their Bulletin vol. 4, is particularly rich in the department of mineralogy.

A Polytechnic Academy, has been established at Brunswick, in which M. C. Hartmann, is the professor of geology.

As to periodical publications in Germany, it is much to be regretted, that M. Keferstein, has discontinued the *Teuchland*. But Prof. Hartmann, has commenced anew the *Annals of Mineralogy, Geology and of Mines*, (*Jahrbuch de Mineral. Geolog. etc.* Nuremberg, 8vo.), and M. Glocker, the *Annual Review of Mineralogy*, (*Mineralogische Hefte*, Breslau, 8vo.). There appeared in 1833, six numbers instead of four, of the Annals of Mineralogy, Geology and Palæontology, by MM. Leonhard and Bronn. The Annalen of Poggendorf, have become weekly. The *Jahrbuch fur den Berg u. Hutten.*, Freiberg, 8vo., has reached its 17th vol. It publishes a minute account of whatever relates to the important mining district of Saxony. M. Freiesleben, has concluded, in the 16th number, his *Magazine*, devoted to the *Oryctography of Saxony*.

M. J. Schikto, has published in Vienna, a work upon the art of mining, entitled *Beitrage zur Bergbaukunde insbes. zur Bergmaschinen lehre*, 8vo.

MM. Frobel and Heer, professors at Zurich, have commenced a journal of Geograghy and Geology, (*Mittheilungen aus d. theoretischen Erdkunde.*)

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reference. M. Boue recommends a more special selection of books in the future management of these great libraries, as likely to be attended with less expense in maintaining a valuable collection, as well as promotive of the convenience of those who frequent them.

M. DEKOBELL has resumed in the Academy of Munich, the progress of Mineralogy, (*Uber die Fortschritte der Mineralogie*. Munich, 4to.)

The annual mineralogical publication by M. GLOCKER of Breslau, entitled *Mineralogische Jahreshefte* deserves to be well received by the public, for at present there is no other work especially devoted to the progress of Mineralogy, a science which is particularly cultivated in Germany. Formerly, LEONHARD performed this service in his excellent Taschenbuch. The progress of chemical mineralogy still continues to be correctly reported in the Annales des Mines, the Philosophical Magazine, and in the yearly reports of BERZELIUS; whilst three or four German journals embrace more particularly the new discoveries of crystallographical mineralogy.

Geology every where makes inroads upon the domains of Mineralogy, so much the more, as the progress of this last science becomes more difficult to follow from the accumulation of chemical analyses, and from the impossibility of seeing and handling what is supposed to be sufficiently indicated by a formula. The Crystallographer gives us at least, the means of recognizing minerals, while the chemist seems to compel us to analyze every mineral that we obtain. M. GLOCKER commences with the recent progress of mineralogy, after which he enters into details concerning the discoveries made in crystallography, and in the physical and chemical properties of minerals; finally, he reviews the different families of minerals, in order to particularize the new species, and the new observations made upon species before known.

FRED. ALEX. HARTMANN has announced a similar work for 1834, under the title of *Repertorium der Mineralogie*, etc. Leipzic, 8vo.

SERAID GRAULHIE has published in London a syntax of mineralogy, or a view of the natural families of simple, double, and compound minerals, forming a circle of affinities. (Syntax of Mineralogy, &c. London, 1833, 1 sheet fol.)

M. C. SAUCEROTTE is about to present under the form of synoptic tables with figures, the Elements of Natural History, and has commenced by giving a table of mineralogy, (Paris, 1833, 4to.)

M. ALEX. BRONGNIART has published a new edition of his *Tableau de la distribution Méthodique des espèces minérales, suivie dans son Cours de Minéralogie.*

F. DEKOBELL has contrived tables for the determination of minerals by means of simple chemical essays by the dry or the humid

way. (*Tafeln zur Bestimmung d. Mineralien*, etc. Munich, 1833, 4to.)

M. G. Suckow has promised a work on Mineralogy for 1834, (*Grundriss der Mineralogie.* Darmstadt, 1834, 8vo.)

Leonhard has given a second edition of his Elements of oryctognosy, (*Grundzug der Oryctognosie*, in 8vo.) He has adopted the chemical system of Gmelen.

Prof. Demetrius Sokolov has published at St. Petersburg, a treatise on Mineralogy, (*Roukovadstvo k. Mineralogii*, 2 vols. 8vo.)

Gustavus Rose has commenced his treatise on Mineralogy, by the publication of the crystallographical part of his work, (*Elemente der Krystallographie*, etc. Berlin, 1833, 8vo.) After the example of MM. Weiss and Ratzeburg, he gives at the end of the volume a complete table of the species arranged according to their different systems of crystallization, adding by the side of each mineral, its chemical formula and occasionally some interesting remarks.

M. Uhde has given a philosophical essay, concerning the developement of the mechanical laws of crystallization, (*Versuch einer genetischen Entwickelung*, etc. Bremen, 1833, 8vo.)

MM. Leopold Pilla and M. F. Cassola, commenced in 1832, a semi-monthly journal of geology, entitled *lo Spettatore del Vesuvio di campi Flegrei.*

The Imperial Mineralogical society of St. Petersburg, have pubished but four Memoirs in 1831. The University of Moscow, commenced in 1833, a monthly journal of Science, entitled *Outcheniia Zapiski imp. Moskovskago Ouneversiteta.* Numerous libraries and cabinets for the illustration of science are rapidly forming in various parts of Russia. Even in the government of Irkutsk, in Siberia, a gymnasium which existed in 1805, has undergone much improvement since 1828. It has a library of many thousand volumes, a physical cabinet, a collection of minerals, of rocks and of shells. In a preparatory school of Mines, mineralogy and the sciences which are connected with mining, are taught.

Russia presents a most remarkable example of the rapidity with which intelligence pervades a community but partially civilized. The government takes the lead in promoting this diffusion of knowledge. The sciences contribute to the augmentation of national wealth, and the researches which this supports, lead to new discoveries.

Geology and mineralogy have particularly engaged the attention of the Russian government, inasmuch as its mineral riches are so widely diffused. The count of CANCRIN, equally distinguished as a philosopher and as minister of state, has for ten years, given a powerful impulse to these studies. The government had undertaken in 1833, eight expeditions, four of which were directed to the Urals, for the purpose of completing a geological map of this important chain of mountains. These enterprises were to be completed in seven years by a general map of these countries.

Information has been sought concerning the district north of the Ural, with a view to extend a knowledge of the auriferous sands. The trans-caucasian region is becoming better known every year. The volcanic soils, and the rich deposits of Glauber's salts, have particularly attracted the attention of geologists. The Oriental acquisitions of Russia also, have been followed by scientific researches. Moldavia and Wallachia, likewise have been geologically explored.

But if Russia merits this tribute for the fostering hand she has extended to science in her own dominions, what shall we say of her cruel policy towards the two principal Universities of Poland, from which she has dismissed MM. PUSCH and ZEUSCHER, their professors of geology, together with the other instructors of these institutions! The collection of the former, has been sold in Russia, and every means employed to prevent the dissemination of instruction within the territory of Poland, in the hope of compelling her sons to resort exclusively to the Russian Universities.

The Hungarian Academy has printed, unfortunately for mankind, in the Hungarian language, its first volume of memoirs. (*Trattner karolyi Nyomtatasa*, 1833, 4to.)

The Natural History Society of the Island of Mauritius, appears to be very actively engaged with the science of Geology. M. J. DESJARDINS, has given some account of its labors in the *Asiatic Journal*, vol. xii, p. 127. An *African Review*, has been commenced in the Island, under the title of the *Cerneen*.

The Asiatic Society, has published since 1832, two volumes of memoirs, relating to geology and geography.

A learned society has been founded at Van Diemen's Land, and a number of persons are engaged in geological observations in New Holland, while GUTZLAFF has commenced a periodical in China, the principal object of which is to make that people acquainted with European science.

AEROLITES.

A mass of iron, partly scoriaceous, found in the environs of Magdebourg, has attracted for many years, the attention of chemists. Some have regarded it as an artificial product, inasmuch as analysis indicated its composition to be different from that of any meteoric iron hitherto examined. M. STROMEYER, who first referred this mass to this class of bodies, has repeated the analysis, and presented various objections against the idea of its artificial origin. He has detected in it a very small quantity of nickel and of cobalt, of molybdena and of arsenic, and a trace of sulphuret of silver: capillary native copper and variegated copper ore take the place in it of magnetic iron pyrites. Now the ores of iron and of copper employed in northern Germany, have never been known to contain any molybdena. This fact would seem to prove that the mass could not have been the product of the furnace.

According to M. BURKART the mass of meteoric iron at Charcas near Catorze in Mexico weighs 9 quintals.

The majority of philosophers have believed, and still think, that aerolites and meteoric iron are elevated to a high temperature while traversing the atmosphere; nevertheless there is but little agreement concerning the degree of heat observed in them immediately after their fall. Recently an experiment of M. BIERLEY, repeated by M. D'ARCET has rendered this high temperature doubtful: a bar of iron, heated to whiteness, was held in the current of air, from the blowing machine of a forge; the metal did not cool, but burnt brilliantly, throwing off glowing particles in every direction. The temperature of the iron rather increased than diminished under the influence of the current of air.

M. JULES LOUIS IDELER has discussed with great learning, the subject of fire-balls, and of the Aurora borealis, (*Ueber d. Ursprung d. Feuerkugeln*, etc. Berlin, 1832, 8vo.) He is the author also of the *Meteorologia veterum Græcorum et Romanorum*, Berlin, 1832, 8vo. and of a work on Hail and the electric phenomena of the atmosphere. (*Untersuchungen uber den Hagel*, etc. Leipzic, 1833, 8vo.)

The facts brought forward lead to the following conclusions:

1. The fall of aerolites generally takes place in summer, and at the period of the equinoxes, that is, in the season of the most abundant rains.

2. The frequency of this phenomenon diminishes from the equator to the poles, whilst in general the annual quantity of rain dimin-

ishes with the mean temperature of localities, allowance being made for the considerable influence of the direction of the winds.

3. The formation of aerolites in a cloud, having their color is analogous to that of rain; as it rains with a clear sky, so in the same manner aerolites descend unattended with the appearance of clouds.

4. The luminous appearance and the noise resembling thunder, are produced by electricity, which appear in all atmospheric phenomena. The different colors of fire balls, during their descent, are the effect of the disengagement of different kinds of electricity. It is very likely that aerolites may fall without being preceded by fire balls, as it rains very powerfully without lightning, when the temperature of the æriform column is below the point of thawing.

5. Aerolites sometimes fall without noise, because the electric explosion has taken place in very elevated regions; there are analogous cases of lightning at the zenith without thunder.

The author therefore regards the formation of aerolites in the atmosphere as the most plausible theory, and recurs to the ideas expressed by Aristotle and Seneca, two thousand years ago: "Varia et multa terrarum orbis exspirat, quædam humida, quædam sicca, quædam algentia, quædam concipiendis ignibus idonea. Nec mirum est, si terræ et omnis generis evaporatio est."

Not satisfied with these observations, M. Ideler adds others, in support of this theory. Thus, he quotes certain hail storms, in which the hail stones possessed a metallic nucleus resembling aerolites; and remarks that the appearance of fire balls and of aerolites is preceded by more or less distinct glimmerings (*lueurs*) of light, and that the phenomena in question is connected with atmospheric changes, and these again with revolutions which take place within the interior of the earth. The simultaneous fall of meteoric stones in different countries is also in favor of their atmospheric origin, and it often takes place during storms.

M. F. G. Fisher has published in the memoirs of the Academy of Berlin, a memoir upon the origin of aerolites, in which he adopts the foregoing ideas, and supposes that electricity performs an important part in the phenomenon.

Concerning the *shooting stars*, M. Ideler endeavors to prove by facts that they are merely precipitations of animal and vegetable matters disseminated through the atmosphere.

Finally, with respect to the *Aurora borealis*, he supposes that the precipitation formed by the dry vapors in the elevated portions of

the atmosphere take place in the regions of the magnetic poles, under the form of the Aurora borealis, for the reason that the ferruginous particles arrange themselves about the pole in an order similar to that of iron filings around a magnetic bar. Future observations upon terrestrial magnetism will aid in explaining the anomalies of this phenomenon.

The vaporization of all solid and fluid bodies goes on under every degree of temperature. When the maximum of density in the vapor is passed, a precipitate occurs, and clouds, cirri, or mists are formed, which rest upon the earth, or a concretionary formation takes place. The latter case happens partly from the condensation of clouds, sometimes under a clear sky, sometimes without electric explosion (aerolites,) or with the phenomena of electricity (fire balls); finally, the fall of these bodies takes place in small particles, or agglomerated into masses of a larger size, and analogous to hail.

If such are the phenomena beyond the polar regions; near the magnetic poles, the precipitates being attracted, would continually be undergoing an arrangement in a circular series, and thus produce the aurora borealis.

This kind of precipitation might take place cotemporaneously with aqueous precipitation, in which case there would occur rains attended by foreign mixtures.

Professor GRUITHUISEN is occupied with the origin of aerolites and shooting stars; and he has proved by mathematical calculations founded upon physics, that these bodies must necessarily be formed beyond our atmosphere, in the interplanetary space, where the metals and the metalloids, he says, are still held in solution by means of hydrogen, and where they exist continually for the formation of these opake bodies.

According to HERSCHELL, the observation of the shooting stars may be useful for the determination of longitude. The height of the meteors seen by M. QUETELET, is estimated at from ten to eighteen leagues from the earth, and their motion at from five to eight leagues per second; results which correspond with those of BRANDES and other German philosophers.

CHEMICAL MINERALOGY.

M. HERZOG has discovered an interesting repository of salts in a cavern upon the Bosjesman river at the Cape of Good Hope. They occur in beds, the upper one of which is composed of a siliceous

plumose alum, and is six inches in thickness. It covers a stratum of epsom-salt, one and a half inches in thickness. The epsom-salt is accompanied by decomposed mineral substances and laminæ of Mica. M. Stromeyer has detected among these foreign substances, silica, alumina, a little iron, manganese, a little lime and magnesia, common salt, sulphate of manganese, &c. A micaceous quartz rock impregnated with alum and epsom-salt supports the whole. The roof of the cave is formed in general, by a quartzose conglomerate containing iron pyrites, and oxide of manganese.

In analyzing the alum of the Cape, M. Stromeyer found that it forms a new sub species to which he gives the name of Manganesiferous and Manganesian alum. He compared it with the fibrous alum found with lignite at Tschernig in Bohemia, because M. Ficinus had supposed that this also was a magnesian alum; but his researches have confirmed the results obtained by MM. Lampadius and Gruner, who had classed it with ammoniacal alum.

M. Stromeyer found the African epsom-salt mixed with a notable quantity of sulphate of manganese. The same chemist was induced by these researches to undertake anew, the analysis of certain saline efflorescences from Idria, Arragon, and Neusohl in Hungary. The Idrian salt instead of being alum, is epsom-salt. The stalactites of bitter salt from Hungary owe their rose red color to sulphate of cobalt, and contain also, sulphate of copper, of manganese and protoxide of copper, as well as water mechanically lodged in their cavities. The saline needles from Arragon are pure epsom-salt.

M. Becquerel has discovered methods for crystallizing in the humid way, the sulphurets, iodides, and bromides of the different metals, and particularly of the metallic oxides.

Galena being volatile and susceptible of being obtained crystallized by sublimation, it has been inferred that this substance was formed in the igneous way, in metalliferous veins. Nevertheless this ore is found in other situations, where the geologist would be led to attribute to it an aqueous origin, if chemical facts were not opposed to it. With his characteristic invention, M. Becquerel applied himself to the question whether this substance could not be crystallized in the humid way. He employed for this purpose a sulphuret of mercury, upon which he poured a solution of the chloride of magnesium; he introduced into the mixture a lamina of lead and closed up the whole hermetically in a glass tube. After the expiration of many months, he found that the lead had passed to the state of a sul-

phuret in consequence of the developement of an electro-chemical action. The contact of the lead with the chloride produces a double chloride, the magnesium is momentarily set at liberty, the lead becomes electro-negative and the solution electro-positive ; the first alters the sulphuret of mercury, while the sulphur which is electro-negative goes to the double chloride. A portion of sulphur combines with the lead of the double chloride and gives rise to a sulphuret, whilst another portion combines with the chloride of magnesium forms a sulpho-chloride. The artificial sulphuret of lead crystallizes in regular tetrahedrons, which is a form comprised within the system of crystallization of the cube, as well as of the octahedron.

M. Bequerel obtained in the same way, analogous results with sulphuret of antimony, zinc and iron.

Geologists must be happy to find this distinguished chemist, applying his knowledge of electro-chemistry, to the study of the alterations which daily take place on the surface of the earth as well as within its interior. In his first memoir on this subject he is occupied with the formation of carbonate of lead upon plates of that metal subjected to the action of carbonic acid coming from the decomposition of wood. In this case, the energy of the action of the acid was augmented by the contact of the metal with a wood already decomposed, and influencing the circulation of the electric fluid.

He has also examined the formation of the phosphate of iron, crystallized in the midst of an accumulation of vegetables, of bones and of fragments of gneiss ; and has been led to observe that the crystals were placed upon fragments of carbonised wood, that is, on the best conductors for reproducing gradually, the neutral fluid, during the continual disengagement of the two electricities, which takes place in the mutual reaction of the different portions of the mixture.

He also remarked, between the layers of the gneiss, phosphate of iron formed at the expense of the iron in the mica, through the action of the solutions containing other phosphates ; the result of the operation was a mica destitute of color.

GEOLOGY.

Origin of Nitre.—The theory of the origin of Nitre is a question of considerable interest to the geologist, not only in itself, but in its connexion with the origin of various other saline substances. M. Gautier de Claubry has described the operation of nitrification,

in a notice of the nitrifiable chalky limestone of Roche-Guyon and Mousseau in the department of Seine and Oise. He concluded that if the chalk contains animal matter in the places from whence the nitre is obtained, that it is too scarce to have any influence upon the phenomenon. Carbonate of lime, without a trace of organic matter nitrifies simply under the influence of the air and of moisture. Under these influences aided by the sun, the chalk might absorb the principles of the air and effect the formation of nitric acid, in consequence of the production of ammonia and its action on azoted substances.

M. Fournet proposes a new explanation of this curious operation. He finds it in the united influence of water and of porous bodies upon the elements of the air, in order to form the protoxide of azote, which combined with water, can give origin to the nitrate of ammonia at once, by a simple isomeric action. This nitrate, decomposed gradually by the carbonate of lime, is converted into nitrate of lime and into volatile carbonate of ammonia, which is withdrawn by the currents of air, necessary for the developement of nitrification.

Origin of Fossil Pyrites.—Iron Pyrites, and Pyritic petrifactions from animal carcases have never been satisfactorily explained. Since gelatinous matter appears to have favored the conglomeration of silica, and consequently the formation of siliceous petrifactions, so likewise the putrefaction of animal matter having produced sulphuretted hydrogen, if any particles of oxide of iron should happen to be present in the surrounding mud, pyrites would be formed, and would accumulate about the places where the gas is disengaged.

Origin of Amber.—M. T. Aessi has discussed anew the origin of amber, which he says is a resin of the Coniferæ. He has examined particularly that Castrogiovanni in Sicily, and he cites, though not with perfect confidence, a specimen of amber containing a land shell. (*Atti dell. Acad. Giœn. di Stor. nat. di Catania, vol.* 6, *p.* 17.)

M. Graffenauer has also given to the Strasbourg society of the sciences, a monograph on amber, which he supposes to have originated in extinct species of trees.

Origin of Sulphur.—C. Gemellaro has read before the Academy of Catania, a memoir, entitled a new theory relative to the origin of sulphur. He supposes that it originates in the decomposition of naked mollusca, and that being acidified by the action of subter-

ranean fire, it has been converted into sulphate of lime, and also given rise to the sulphate of strontian, which in the tertiary clays of Sicily is associated with the preceding minerals: an idea which may well be compared with the ancient opinion that volcanoes are kept active by the inflammation of coal beds.

General view of the Progress of Geology for 1833.—The number of observers has become so great, that one year suffices to give us information respecting the largest part of the globe; in a few years no countries will remain untrod by the feet of civilized man. The past year has been especially remarkable for the important descriptions it has furnished of the three peninsulas of Southern Europe, of Mexico, South America, and Hindostan. For the rest, England, France, Germany, Italy, Russia and the United States continue to hold the first rank in this kind of publications. Their number gives after the order in which they have been mentioned, the succession of the following figures: 45, 46, 31, 19, 15, and 16.

Of treatises on Geology, those of Lyell and De la Beche are the most distinguished of this period. As to particular subjects of geology, numerous facts have been collected, especially in France, England and Germany. Upon craters of elevation, the theory of dislocations and of the formation of mountains has been perfected; finally new ideas have been daily made respecting the origin of certain rocks, such as the quartz rocks, primitive limestone, porphyry and trap. Mineral waters and artesian wells continue to afford interesting observations. During 1833, they have principally been made in Germany, France and Italy; and the theory of their origin as well as that of internal heat, is becoming better and better established, especially in England and France. Palæontology does not cease to develope the riches of the ancient vegetable and animal creations. The year, 1833, has been marked by the appearance of special works, upon plants, and different classes of animals, such as the mammiferæ and the fishes. If Germany has taken the lead in information relating to fossil geology, it has not furnished more than France and England concerning vegetable impressions. In palæontology, all other countries except the United States are quite in the back ground. This proves that a highly advanced state of civilization is necessary for the entire and minute cultivation of a science, as well as for the discussion of the highest theoretical questions, whilst works purely descriptive are well adapted to a less advanced state of national intelligence.

This likewise furnishes the key to the differences between the numbers of the theoretical and descriptive publications made in the different countries.

The works and memoirs for 1833, may be divided and arranged as follows :—

	Treatises.	Memoirs.	Total.
Astronomy, - - -	10	10	20
Physics, - - - -	3	20	23
Magnetism, - - -	2	38	40
Meteorology, - - -	12	43	55
Chemistry, - - -	5	42	47
Hydrography, - - -	2	13	15
Mineral Waters, - -	22	21	43
Artesian Wells, - - -	3	15	18
Natural History, - -	29	41	70
Mineralogy, - - -	24	29	53
Physical Geography, -	32	11	43
Treatises on Geology, - -	15	8	23
Particular subjects of Geology,	3	22	25
Memoirs on Volcanoes, -	2	2	14
——— Veins, - -		5	5
——— Craters of elevation,		16	16
——— Elevations, - -		14	14
Geological Geography, -	22	208	230
——— Maps, - - -			31
——— Sections, -			28
Levelings, - - - -	1	13	14
General Palæontology, - -	3	1	4
Fossil remains of Man, - -		2	2
——— Mammiferæ,	2	22	24
Caverns with bones, - -	1	10	11
Fossil Reptiles, - -	1	6	7
—— Fishes, - - -	1	7	8
Crustaceous Fossils, - -	1	5	6
Molluscous, - - -	5	17	22
Fossil Plants, - - -	4	11	15

There have appeared then, in the physical and natural sciences, 144 treatises and 276 memoirs, in the whole; and in geology and palæontology, 61 treatises and 414 memoirs, or in the whole 205 treatises and 690 memoirs, or 895 publications.

The relation of the different numbers of these two kinds of publications, peculiarly characterizes our epoch, in which, besides the ruling spirit of association, there exists a strong disposition, to render public, ideas as soon as they are conceived. The *ilotism* of philosophers has ceased along with the publication of voluminous works, which formerly appeared from time to time, as rareties, and were the labors of an entire life. If formerly they produced sometimes perfect works, isolated authors did not enjoy as now, the advantage of obtaining information by discussion, during the composition of their works. Occupied thus by themselves, they were more apt to be misled than at present, where each chapter of a treatise is dissected beforehand in the periodical journals.

In comparing the number of works of 1833 with those of 1830, 1831 and 1832, we find the ratio to be expressed by the following figures: 300, 450, 500 and 900.

ART. XVIII.—*Notice of the "Travels of a Naturalist in the Alps;"* Read before the Society of Naturalists at Soleure, by their President, FR. JOS. HUGI. (Naturhistorische Alpenreise. Vorgelesen der Naturforschenden Gesellschaft in Solothurn von irhrem Vorsteher, FR. JOS. HUGI, Lehrer.) By C. U. SHEPARD.

ALTHOUGH it is more than four years since this volume made its appearance, its contents are so valuable and entertaining as to merit being made known to such American readers as feel an interest in Geology and Meteorology. It deserves the more attention also, as we have, even in New England, a sub Alpine range still unexplored, and of whose geological character we know little else, than that a few of its elevations consist chiefly of granite, gneiss and mica slate;* whilst its meteorological phenomena have been wholly neglected.

The travels of Hugi were chiefly in that portion of the Helvetian Alps, known as the Bernese Alps, extending along the north of the Rhone, from the lake of Geneva to the valley of Unterwallden. He also made excursions through the neighboring parts of the Pennine Alps, and thence over St. Gothard to the valley of Uri; he likewise visited the Rigi and Mount Pilate.

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* In Vol. XVIII. p. 291 of this Journal, I pointed out the existence of a brecciated rock, consisting of fragments of argillite as existing high up the sides of the Kearsage peak at Fryeburg, Me., which serves to render doubtful the supposed homogeneous character of these mountains.

His journeys were prosecuted during the years 1828 and 29; and the work in its numerous maps, geological sections, and tables of meteorological observations at various remote and elevated points, evinces an extraordinary activity, while its details make known some of the most toilsome and hazardous adventures recorded in the history of geology, probably not excepting those of SAUSSURE.

Unaided by the sections appended to the volume, it is difficult to do justice to the author's geological observations. With a view however, to render intelligible the general structure of the Bernese Alps, we give the following description of the strata from the Lauterbrunnen valley to the summit of the Jungfrau.

1. Lowest, proper granite, including strata of gneiss and mica slate.
2. Alpine limestone, (Muschelkalk).
3. Greywacke interposed formation, (Wacke).
4. Lias.
5. Secondary granite, (High granite).

The lowest of these limestones, or that which rests immediately upon the primitive granite is characterized as follows: Its color is ash or smoke grey, sometimes with a shade of blue or red, but wherever in contact with the granite it is white. More rarely it is black, in which case it becomes siliceous and is veined with Calcareous Spar. Its fracture is even, and mostly large conchoidal, excepting where in contact with granite or gypsum, when it becomes granular. It is considerably siliceous, frequently bituminous, and is regularly stratified in thin layers. It is a remarkably uniform formation, suffering no other transition than into a white granular dolomite when in contact with the proper granite. The thickness in some places is very great, while in others it is very thin, in which case, it contains petrifactions.

Next in the ascending order, occurs the interposed formation, consisting of a pisiform iron stone, a granitic sandstone (composed of granitic materials) and a porphyritic greywacke. Its commencement and progress, from below upwards, is thus described. At first the lime begins to diminish, being replaced by alumina and oxide of iron. It is only in the highest strata of the Alpine limestone that organic remains begin to occur, such as Ammonites, Mytilites, Terebratulites, &c. At this point, the limestone formation must be regarded as having reached its termination. Suddenly organic depositions cease; and the strata pass into a quartzose pumice-like conglomerate, held together by a calcareous cement. Grains of feld-

spar are also discernible in the aggregate in certain places. By degrees, as the formation proceeds, it becomes a homogeneous, siliceous slate, which in many places is also vesicular. The quartz now suddenly disappears, and the particles of feldspar only remain. The general mass becomes a blackish, slaty clay with a shining shistose surface and a coarse cross fracture, in which individuals of white feldspar are visible. An increase of lime now commences, and with it reappear the petrefactions, such as Belemnites, Ammonites, Mytilites, Terebratulites, &c. This porphyritic greywacke-slate may be regarded as the commencement of the lias, while the pisiform ironstone forms the conclusion of the Alpine limestone; consequently only the granitic sandstone can be considered as constituting the intermediate or interposed formation.

As the lime obtains the ascendancy in the porphyritic slate, the feldspar disappears, and the earthy granular fracture changes into a pisiform or concentric granular structure; the Belemnites and Ammonites disappear, while the Terebratulites, Mytilites, &c. still remain, but only in the inferior layers. It is of immense thickness, and is characterized as follows: The color is black; when the lime predominates, (in consequence of which the layers become thicker,) its structure is oolitic and frequently crystalline; but when alumina prevails, (which renders it shistose,) the cross fracture becomes even and sometimes splintery; and finally, when silica is superadded in large proportion to both, the texture becomes coarse, like that of greywacke. No formation is so protean as this; at one time, it presents us with a series of wackes, at another with marls, gryphite-limestone, &c. Indeed, Hugi is of opinion from a close examination of the Jura and the Alps that these, as members of one and the same leading formation, occupy under a multiform alternation with each other, nearly the entire space between the Alpine and Jura limestone.

It appears therefore, that with a single interposed formation, the Alps contain but two leading limestone formations, above which occurs, in particular spots, a third, the chalk with Jura limestone.

It remains, in the enumeration of the Alpine series, to speak of the secondary granite, whose existence the author seems to have established on very satisfactory grounds, notwithstanding the opinion of some geologists that what he has taken for granite is only a variety of sandstone. The observations of Elie de Beaumont in the *Montagnes d l' Oisans** fully confirm the ideas advanced by Hugi.

* This geologist found granite cutting through, and resting upon, deposits belonging to the oolite series.

This granite forms the most elevated portions of the Bernese Alps, and generally reposes upon the lias, though in some instances where this basis is wanting, it rests upon the Alpine limestone, or even on primitive granite. The name high granite (*hochgranit*,) is given by Hugi in allusion to its forming the summits of the mountains. As represented in the views contained in the work, it sometimes offers a strong resemblance in the abruptness of its elevations to trap formations; although it is on the whole, more prone to form needle shaped summits than the latter rock. The author also calls it halfgranite, (*halbgranit*,) probably owing to the differences in internal structure between it and primitive granite. Some of its peculiarities are the following: It is very liable to decomposition, and particularly so, near the summits of the peaks, where masses readily separate into irregularly shaped fragments, which are stained red or black on the outside. Even the entire surface in some places is red from oxide of iron, (whence the name *Rotthal**,) or black from the oxide of manganese. It is tolerably fine grained: and the ingredients are in general uniformly distributed, with the exception of the mica, which is sometimes collected into balls by itself. The quartz occasionally preponderates, and in some cases hornblende is substituted for mica or is superadded to it.

The mode of occurrence observed by the fossils is the same throughout the Bernese Alps as has been observed in the Jura. They appear plentifully, only when the formation approaches its state of transition, where the lime begins to be replaced by alumina and silica. If however, they do occur in more homogeneous strata, that is, in the leading formations themselves, they are principally confined to the lowest and to the highest layers, near the commencement and the termination of the formation. Terebratulites and a few other bivalves appear to form an exception to this law, these fossils enjoying a wider distribution. Another law relating to organic remains is that their number is, in general, in an inverse order compared with the thickness of the formations. This is quite generally the case throughout the Alps. The white Jura limestone, wherever found in considerable thickness as on the Balm near Soleure, affords no vestige of fossil remains, even when examined from the bottom quite to the top. It was partly on this account that it was erroneously regarded as the oldest formation of the chain. Yet when this

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* Red Valley.

same formation was examined at points where its thickness was less, petrifactions made their appearance. The same holds true in the interposed marl, and in the members of the lias, the oolites and muschelkalk. When however, petrifactions do occur (which is somewhat rare,) in the thicker portions of a formation, the same species are always smaller than when found where it is thinner, which fact has been observed also both by STUDER and BOUE. HUGI remarks still farther, that the petrifactions of the Jura prevail through the Alpine chain generally, but less frequently and of a smaller size; and he suggests the law, that the larger the dimensions of mountain chains, the smaller are the size and number of their fossil contents.

It is natural that such favorable opportunities for geological observations as the Alps present, should suggest some theoretical views concerning the origin of formations; and whoever peruses this volume would indeed be surprised if the highly imaginative temperament of its author could be restrained to the humble, though often arduous, labor of mere description. Accordingly, commencing his concluding section but one, with the motto, "*Sterilis est voluptas contemplandi naturæ opes, ubi ad illarum causas indagandas non procedit ratiocinatio,*" he proceeds to give his theory, which may be stated succinctly as follows: There are three classes of formations, the primitive, secondary, and tertiary. The primitive is formed by crystallization or deposition from a fluid state. It includes two series. The first embracing gneiss and mica slate was formed from without, inwards; the second consisting of muschelkalk (Alpine limestone,) lias and Jura limestone, was formed from within, outwards. The secondary, to which belong granite, sienite, porphyry half granite, and also gypsum and dolomite, was formed from an internal metamorphosis, (chemical change,) attended with the extrication of gases and upheavings, before the primitive had reached its fixed state. Tertiary, includes dolerite, basalt and lava, and was formed from the primitive or secondary by an internal metamorphosis after they had reached their fixed state. This metamorphosis he imagines to be the result of a living, active principle, pervading all nature.

It is obvious that this theory is adapted with considerable skill to the phenomena of Alpine geology; nor does it so far differ from the current notions in the science, as to be incapable of an easy translation into such views. But to propose the living activity of the earth in explanation of geological appearances, is quite as remarkable as

it would be, to assign molecular attraction as the cause of mental phenomena.

It was one of the principal objects of the traveller to ascend the Finsteraarhorn, the highest and most central peak of the Bernese Alps, and which rises out of the great ice-sea. Several incidents connected with the execution of this undertaking deserve to be noticed. Two unsuccessful attempts were made before the object was accomplished. The following statements relate to the first journey. After much fatigue and no inconsiderable danger, from the numerous crevices in the glaciers, the party encamped near the foot of the peak at an elevation of 10,000 feet, and on the following morning commenced their ascent. The snow had become so hard during the night as to receive no impression under their feet. Over this they were forced to travel some time to reach the ridge. The ascent at first was over naked rocks, whose high inclination required the most excessive exertion. For the first time in his life, the author says, he experienced the pain of thirst, added to which he was near sinking from fatigue. The only relief to thirst, was found in placing the lips upon the rocks wherever any drops of water were seen trickling down. To eat the snow, only aggravated their suffering. Nor was it sufficient to drink the freshly melted snow-water; it was requisite that it should trickle for some distance over the rocks before it became refreshing. This he attributes to the absorption of carbonic acid from the atmosphere. They were thus advancing towards the summit, when suddenly, a powerful gale arose from the west. Notwithstanding its violence increased every moment, they still pressed forward in the hope of accomplishing the wished-for object; when they were within two hundred feet of the summit, they encountered a declivity so steep that they were obliged to cut holes in the snow for their hands and feet to enable them to ascend. This detained them a long time. The moment, says Hugi, was awful, and an indescribable expression was visible in every countenance. They were on a ridge of snow so narrow as scarcely to allow them foothold. To the east the Grindelwald ice-sea and the Finsteraar glacier were perpendicularly below them, forming a dreadful abyss, and on the opposite side a surface of snow, steeper than the steepest roof, descended among wild crags to the Vieschergletscher. From this dangerous situation Hugi with four of his companions resolved to advance, while the rest of his attendants were to occupy themselves in hewing steps in the snow for their easier descent to the ice-sea. Hav-

ing given orders to proceed, one of his companions who was in advance, in climbing along the steep ridge slid off towards the west. As he fell, Hugi caught the end of the long pole with which he was furnished and which projected over the eastern side of the ridge. At that moment, the snow on which Hugi stood gave way, and in consequence, he hung dangling over a precipice four thousand feet in depth, while his companion was in like manner suspended on the opposite side of the ridge. In this position they remained until their companions were able by means of cords to secure them from the death which momentarily threatened them. The undertaking was now abandoned, and the whole party hastened down the mountain having suffered severely from the cold.

The undertaking was renewed the following year, on the third of August; the attempt however was abandoned in consequence of a violent snow storm, but was resumed on the ninth, on the evening of which day the party encamped behind the Finsteraarhorn. It was a clear moonlight night and the atmosphere was perfectly motionless. So bright was the light as to enable Hugi to note down his observations as easily as in the clearest days, and he could perceptibly distinguish single dwellings, the least remarkable objects upon the remote side of the Valais on the Pennine Alps. The whole chain with its thousand peaks even to Mount Blanc was distinctly visible. In short, every object appeared far more distinct in the distance by moonlight, than it had done in an equally clear atmosphere a few hours before sunset, when it was impossible to discern these remote objects. Every thing distant was lost in a sort of magic haze during the prevalence of day light. The blue of the sky, as described by other Alpine travellers passed, as the observer ascended, by a singular gradation from azure through dark green to a dusky black. On the following day the party reached the summit of the Finsteraarhorn, and erected a flag of iron wire covered with oil cloth upon its highest peak, which in fine weather is visible even from Soleure. The party suffered severely from the cold. The two who erected the pyramid on the summit for the support of the flag staff were observed to be of a death-like paleness when they descended to join their companions. The thermometer stood at $-2°\ 4'$ Reaum, and the barometer at 16, 11, 70. Water boiled at $70°\ 10'$, and alcohol at $53°\ 2'$ Reaum. The mean of the author's observations gave the elevation of the peak, 13,033 feet above the level of the sea.

The volume contains a description of an interesting meteorological phenomenon, called atmospheric cannonade, (*wetterschiessen*). It was witnessed near the foot of the Jungfrau, but is common throughout the Bernese Alps. It resembles a distant cannonade. The occurrence is most frequent about the time of mid-summer, though it occasionally happens in autumn. It has no connexion with ordinary thunder storms. The sky from perfect clearness becomes slightly hazy in a manner indescribably peculiar as the sounds commence. It was observed on one occasion by the author in the middle of August. The forenoon was sultry, but clear. At about six, P. M. the atmosphere assumed a peculiar haziness which led the inhabitants to predict rain. The wind was northwest, not from the Alps, but towards them from the valley. The barometer was much agitated, and the hygrometer, high. The sound was at first repeated two or three times each minute, afterwards at longer intervals. It was a quarter past eleven before it wholly ceased.

The weather was cloudy in the morning, rain soon followed. Several singular superstitions concerning it prevail among the common people; some attributing it to the firing of the old feudal lords of Rotthal, others to that of the Burgundians on the field of Murat, while the more intelligent refer it to the firing of cannon at Berne, Soleure, or Neuenburg.

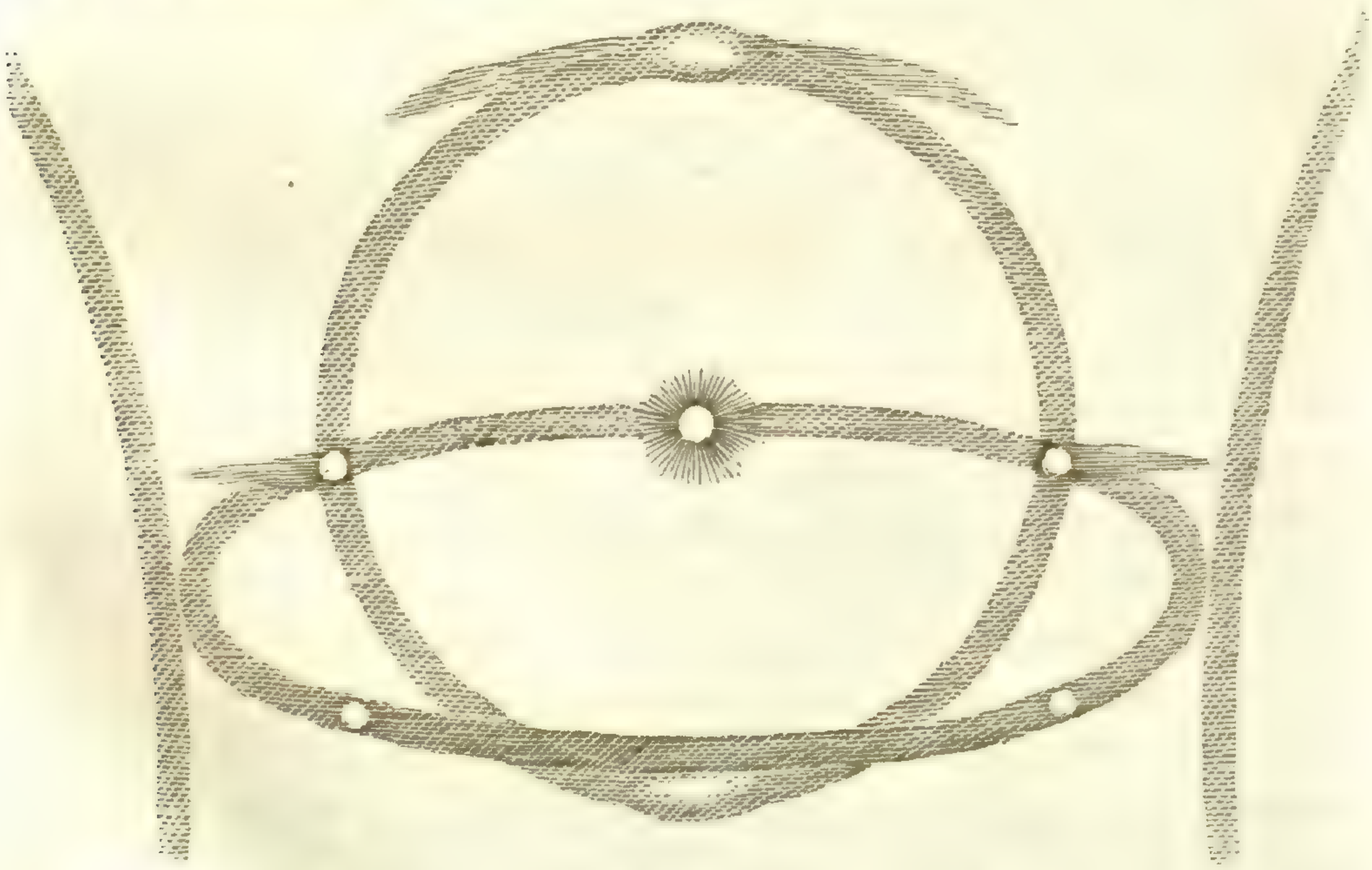
A section is devoted to the glaciers and the distribution of snow into the annual melting snow, and the *firn*. The latter is a granular deposit upon the highest mountains and valleys, and forms the ice-sea, or rather the *firn*-sea. The glaciers issue from the *firn* and descend through valleys and ravines or along the slopes of the mountains. The red snow, found only in the lower part of the *firn* is a lichen, the *Palmella nivalis*. It is never found in the annual snow, or upon the glaciers, but invariably in the *firn*, on sunny slopes where it particularly flourishes.

The work is not confined to geology and meteorology, but includes valuable notices in botany derived from the author's friend Jacob Roth of Soleure. Entertaining sketches respecting the manners of the mountain population, their herds, and pasture-lands are also introduced. The style throughout the work is animated and pleasing, occasionally becoming poetical in the description of Alpine scenery.

Art. XIX.—*Remarkable Parhelia, seen at Fort Howard, (Green Bay) Michigan Ter.;* by Lt. R. E. Clary.

Communicated for this Journal.

A very singular and interesting phenomenon was observed in the heavens at this place, (Fort Howard, Green Bay, M. T.) on the morning of the 27th of February last. It consisted of a large and brilliant halo around the sun, with two parhelia within the circumference at the extremities of its horizontal diameter, but little inferior in brilliancy to the true sun; they were accompanied by luminous trains or tails opposite to the sun. Immediately above and beneath the sun in the circumference of the same circle, there were bright luminous spots of an elliptical form, less intense in brilliancy than the first, but of much greater magnitude. From the superior or more elevated spot, rays faintly colored, and slightly curved downwards, appeared to emanate, forming a small portion of an arc of a circle of less curvature than the halo. Another circle, the plane of which was horizontal, at right angles to, and of a greater diameter than, the first, with its center apparently in the zenith, completely surrounded the heavens; its circumference passed through the sun, and two mock suns, the latter being distinctly reflected in the opposite part of the heavens.



About 15° from the zenith, in the direction of the sun, there appeared two faintly luminous arcs of circles, nearly tangent to, and convex towards, each other, they were but a few degrees in extent.

Two well defined and tolerably brilliant rainbows, situated upon the right and left of the Parhelia, with their convexity towards it, completed this rare and interesting appearance.

This phenomenon was first observed a little before 8 o'clock, the lower part of the halo being then about 2° above the horizon, its diameter descending as the altitude of the sun increased; arrived at its greatest degree of brilliancy and splendor 15 minutes before 10, when it began to decrease, and finally disappeared about 15 minutes before 11 o'clock, the total duration of the phenomena being about three hours.

The morning was extremely cold, the mercury standing at 16° below zero, and the atmosphere was uncommonly clear and serene. In the afternoon it became cloudy and indicated snow.

The same phenomenon with some modifications in its appearance, was, I understand, observed at Fort Winnebago, 113 miles south west from this place, which is in Lat. 44° 30′.

By the accompanying diagram I have attempted to convey an idea of the position and appearance of the halo, horizontal circle, rainbow and parhelia with their reflections as they appeared 15 minutes before 10 o'clock. A greater number of reflections perhaps, than were ever witnessed at one time before, all depending upon the same peculiar state of the atmosphere for their existence.

March 6, 1835.

ART. XX.—*Replies to a Circular in relation to the occurrence of an unusual Meteoric Display on the* 13*th Nov.* 1834, *addressed by the Secretary of War to the Military posts of the United States, with other facts relating to the same question*; by A. D. BACHE, Prof. of Nat. Philos. and Chem. in the Univ. of Pennsylvania.

HAVING found that the inference drawn from my observations on the morning of the 13th of Nov. 1834,* at Philadelphia, was directly opposite to that to which Professor Olmsted had been led, from his observations at New Haven, I felt naturally desirous to determine what might have been the extent of country over which

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* See this Journal for January, 1835, p. 337.

the unusual display of meteors seen at New Haven had taken place; this extent having a direct bearing upon the question of the nature of the phenomenon. At my request, communicated through the kindness of the Chief Engineer, the Secretary at War, Gov. Cass, issued a circular to the commandants of the different military posts of the United States requesting to be informed whether any unusual meteoric display had been witnessed at their respective posts on the morning of the 13th of Nov. 1834.

The results of this inquiry, I propose now to put upon record in as brief a manner as possible. The arrangement adopted in the record is to begin with the most northern post on our north eastern frontier, to pass southward along the Atlantic board; then beginning with the most southerly post of the western chain to pass northward along that chain, then eastward on the northern frontier towards the original point of departure. Along this line the display of November 13th, 1833, attracted universal attention.

From Hancock Barracks, Holton Plantation, Maine, Maj. Clarke reports that no recurrence of the meteoric phenomenon of 1833 was observed on the 13th of Nov. 1834.

A similar report is made, by Maj. McClintock, in relation to Fort Preble, Portland, Maine, and its vicinity.

No unusual meteoric phenomenon was observed at Fort Constitution, Portsmouth, New Hampshire, as stated by Maj. Ansart; nor at Fort Trumbull, New London, Connecticut, as stated by Maj. Saunders; nor at Fort Hamilton, New York Harbor, according to the report of Maj. Pierce; nor at Fort Severn, Annapolis Maryland, according to Maj. Walbach; nor at Fort Washington, Potomac River below Washington City, according to Maj. Mason.

Maj. Churchhill states that at Fort Johnston, Smithville, North Carolina, no unusual meteoric appearances were noted on the evening referred to in the circular, but that no one was particularly engaged in watching for a recurrence of the meteors of 1833.

Maj. Gale reports from Fort Moultrie, Charleston Harbor, that he can find no one in the garrison or its vicinity who has seen any unusual meteoric display since Nov. 1833; and the report of Lieut. Williamson from Castle Pinckney, in the same harbor, is to the same effect.

Capt. Marchant makes a similar report from Fort Oglethorpe, Savannah, Georgia.

From Fort Marion, St. Augustine, E. Florida, Capt. Drane reports that no recurrence of the meteors had been observed, and that no remarkable meteorological occurrence was recorded about the period designated, in November.

No recurrence of the meteors was observed at Fort Jackson, on the river Mississippi, below New Orleans, commanded by Capt. G. M. Gardiner.

General Atkinson states from Jefferson Barracks near St. Louis, Missouri, that no occurrence of the sort alluded to in the circular was observed in the autumn of 1834 by "any one at the post, nor was there such a recurrence any where in the west as far as [his] inquiries had extended."

Lieut. Col. Vose reports from Fort Towson, on the Red river below the mouth of the Kiameche, that no recurrence of the meteors had been observed as far as he could learn in the section of the country in which the post is situated.

Col. Dodge commanding the regiment of dragoons, reports from Fort Leavenworth, on the Missouri river, at the junction of the Little Platt, that no remarkable meteoric phenomenon had occurred since his arrival at the post on the 27th of September; he adds that "a recurrence of an event so remarkable as the one mentioned, could not have escaped the notice of the sentinel on post."

From Fort Snelling, Falls of St. Anthony, Upper Mississippi River, Maj. Bliss reports that from an examination of the sentinels who had been on post during the night of the 12th and 13th of Nov. he could not learn that any recurrence of the meteoric phenomenon of 1833, had been observed. He gives a particular account of a very bright meteor seen at 5 o'clock A. M. on the morning of the 9th of January, 1835.

Lieut. Col. Davenport, commanding at Fort Armstrong, Rock Island, Upper Mississippi river, Illinois, states as the result of information, which is satisfactory to him, that no meteoric phenomenon was observed on the 13th of Nov. 1834, at his post. He gives the temperature at 7 o'clock A. M. on the 13th of Nov. as 42° Fah., the wind N. E., and the weather fair.

The reports from Fort Dearborn, Chicago, Illinois, commanded by Maj. Green, and from Fort Winnebago, portage between the Fox and Ouisconsin rivers, N. W. Territory, commanded by Lieut. Col. Cutler, state that no unusual meteoric display was noticed there on the night referred to.

The return from Fort Howard, Menomoniveille, Michigan Territory is of the same purport, General Brooke adding that there were several apparent shocks of an earthquake in Nov. 1834, as evidenced "by a severe rocking of the flag-staff in the night, although it was perfectly calm at the time."

From Fort Mackinac, Straits of Michilimackinac, Michigan Territory, Capt. Clitz reports that he has "made inquiry of the sentinels who were on post on the night of the 13th of Nov. last, and *one* only, an intelligent young man who was posted at the north angle of the fort saw a shower of meteors in the north between 12 and 1 o'clock, the duration of which as near as he can recollect was about one hour."

Maj. Hoffman reports from Fort Gratiot, on the St. Clair river, that no recurrence of the meteoric phenomenon of 1833 was observed at his post.

The returns just given, are from eleven posts in the Atlantic States from Maine to East Florida, from six posts in the Western States or frontier, and from five on the northern frontier; they agree in stating, with one exception, that no unusual meteoric display was noticed on the night of the 12th, 13th of November, 1834.

It is almost needless to observe that the military stations are places where observation of any striking meteoric phenomenon may be expected, at least one sentinel being on post, the reliefs being posted by a non-commissioned officer, and the sentinels visited at least once during the night by a commissioned officer. Vigilance is particularly to be expected in our out posts from which the reports are quite minute. A local "shower" of meteors was observed by a sentinel at Fort Mackinac, about midnight and lasting about one hour. Many of the reports do not confine themselves to a statement that no meteoric display was witnessed at the posts, but include inquiries made in the vicinity.

These reports may I think, be considered conclusive against the occurrence of any extensive and remarkable display of meteors, so far as ordinary observation could have detected such a display.

In reply to letters addressed to friends in different quarters, with a view to ascertain if special observation had been made on the morning of the 13th of Nov., I received the following information.

At New York, as I learned from Prof. Renwick, a gentleman well known for his scientific attainments, assisted by a friend, watched during the whole night, but saw no remarkable occurrence of

meteors. Doct. Gibbons of Wilmington, Delaware, observed the heavens, in connexion with his observations on the aurora, until about half past twelve o'clock on the morning of the 13th of Nov. He informs me that he has been in the habit of inspecting the heavens, frequently, every clear evening since November, 1833, and has observed often an unusual number of meteors for several evenings in succession, and sometimes the reverse of this. The night of the 12th, 13th of Nov. 1834, was clear.

No unusual occurrence of meteors was noticed at Baltimore by the city watch, or others, to whom inquiry was directed by Prof. Ducatell; nor at the University of Virginia, nor at the University of North Carolina; at which places, as I learn from Professor Patterson, and Professor E. Mitchell, no special observations were made. At Cincinnati, Ohio, the night was cloudy, with showers.

President Lindsley of Nashville University, informs me that one of the gentlemen at the University was on the look out on the night of the 12th, 13th, but saw nothing remarkable.

The direct observations made at New York, Philadelphia, and Nashville show that no unusual meteoric display occurred at either of these places, and the general experience at Baltimore, and Wilmington, Delaware, the University of Virginia, and the University of North Carolina, was to the same purport. As far as public testimony through the journals, can reach this point, it confirms these conclusions.

I infer that the meteors seen at New Haven, from 1 o'clock until day light, by Prof. Olmsted and the gentlemen who assisted him; at West Point after two A. M. by Mr. Twining; at Machinac, between twelve and one o'clock, by the sentinel, were not parts of one meteoric display, visible over an extensive region of country like the phenomenon of Nov. 1833, but were local.

It is to be seen from the foregoing statements that the weather was not the same over the extent of country which they embrace, while on the 13th of November, 1833, there was a most remarkable uniformity over a much greater surface.

Philadelphia, May 28th, 1835.

Art. XXI.—*On the evidence of Certain Phenomena in Tides and Meteorology;* by W. C. Redfield.

(From the Journal of the Franklin Institute.)

The "Notes of an Observer,"* containing some strictures on two papers relating to meteorology, which are found in the twenty third volume of the American Journal of Science, are doubtless entitled to notice from the writer of this article, which would have been more promptly given, had those strictures met his eye at the time of their publication; but he had, unfortunately, no knowledge of their appearance, till a few days since, when chance brought them under his observation.

The intelligent writer of the notes introduces his strictures on the two papers alluded to, by the following remarks:

"They contain a most laborious collection of facts, which, if well authenticated, will be of immense importance to meteorological science. Some of them, however, are so anomalous, and inconsistent with received theories, that I hesitate to put entire confidence in them, and shall continue to doubt until I have the most certain evidence of the facts."

As was partially intimated in those papers, circumstances do not permit me to set forth in detail the great mass of evidence and authorities by which the statements in those papers are sustained, or even to such an extent as I deem to be highly desirable. It does not, however, seem necessary that facts in this department of science should be rejected, or even doubted, for no better reason than being "inconsistent with received theories;" for while, in the present improved state of physical science, we are so justly rigid in demanding correct inductions from well observed or established facts, before we consent to give credence to *new* theories, it may be well, perhaps, to inquire when, and in what manner, the "received theories" in meteorology have been demonstrated to be true. That the theories in question have long been received, and that they influence and control our modes of thinking and reasoning on these subjects, is doubtless true; and it is believed that the latter often happens, too, in the face of much positive evidence of their fallacy. Nor is such a mental process at all uncommon, even in this age of the exact sciences, and I have had occasion to see the most unsupported and

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* Journal of the Franklin Institute, Vol. xiii, p. 9.

conjectural hypotheses adduced by able writers, as satifactory disproof of a series of well observed facts. But to return to the "Notes of an Observer," who proceeds to particularize his exceptions as follows.

"For example: In p. 132 he says, 'In large portions of the Pacific Ocean, the tides are exempt from the lunar influence. At Tahiti and the Georgian group, near the centre of the Pacific Ocean, the tide rises but one or two feet, and it is high water at noon and midnight throughout the year, and this, too, in the very region where the established theory would lead us to expect the lunar tides to be the most regular and powerful.' Again, in p. 128, he says: 'In Peru, at the height of 18,000 feet, the wind has been found to be fresh from the south west,' meaning, if I understand the whole paragraph, that this is the prevailing direction of the wind at that place."

Without inquiring whether the closing inference here quoted be justly warranted by the paragraph to which he alludes, I have to remark that it is *possible* that my statement in regard to the tides at the Society Islands, and certain other parts of the Pacific, may prove not to have been sufficiently guarded. We should naturally think that, even in the absence of such lunar influence, the momentum of the tides from other portions of that great ocean would necessarily affect the equilibrium of the surface at these islands; and Prof. Whewell, in his able elucidation of the cotidal lines, has given the time of high water at these islands, without any direct intimation of such phenomena. But, we have the authority of gentlemen who have been attached for many years to the English missions at these islands, and who, from their known habits of life, must be supposed to be thoroughly conversant with the facts of the case, in support of the statement which I have made. The following statement of the Rev. William Ellis, one of the gentlemen alluded to, and who has returned to England, may be found in his Polynesian Researches, at p. 289, Vol. I, of the second London edition.

"Among the natural phenomena of the South Sea Islands, the tide is one of the most singular, and presents as great an exception to the theory of Sir Isaac Newton, as is to be met with in any part of the world. The rising and falling of the waters of the ocean appear, if influenced at all, to be so in a very small degree only, by the moon. The height to which the water rises, varies but a few inches during the whole year, and at no time is it elevated more than a foot, or a foot and a half. The sea, however, often rises to an unusual height, but this appears to be the effect of a strong wind blowing some time from one quarter, or the heavy swells of the sea, which flow from

different directions, and prevail equally during the time of high and low water. But the most remarkable circumstance is the uniformity of the time of high and low water. During the year, whatever be the age or situation of the moon, the water is lowest at six in the morning, and the same hour in the evening, and highest at noon and midnight. This is so well established, that the time of night is marked by the ebbing and flowing of the tide, *and in all the islands the term for high water and midnight is the same.*"

A fact which is thus substantiated, and which has become incorporated into the very language of a whole people, it would be difficult to call in question. It is supported also by the testimony of Messrs. Tyerman and Bennett, in their Journal of Voyages and Travels,* to say nothing of facts collected from other sources, or which have the same bearing, though relating to other regions. I will mention, however, that Mr. Whewell quotes the observation of Capt. Beechy, that at Papiate, one of the Society Islands, it is high water *every day* at half an hour before noon, and low water at six in the evening; and he also informs us that Lieut. Malden (Lord Byron's voyage) gives a similar account of the tides at Owhyhee, situated in a corresponding latitude and position in the *northern* Pacific. In the last number of the American Journal of Science,† we have also a further confirmation of the fact in question, as given us by Mr. John Ball of Troy, New York, at the close of his interesting account of the country west of the Rocky Mountains; he says, "A return from the Columbia river by water around Cape Horn, touching at the Sandwich and Society Islands, gave some opportunity to observe the winds, and other phenomena." "During three weeks stay at Tahiti the tide was observed to rise about one foot, and always highest at twelve o'clock, noon and midnight, and I was informed that this is always the case."

It must, therefore, I think, be admitted, that there is a suspension or neutralization of the lunar tide-wave in the region in which those islands are situated. We find, too, that in the Atlantic it is high water on the coast of Surinam about five o'clock on the days of the new and full of the moon, and the flood runs to the westward. At the windward islands of the West Indies, the tide is some one or two hours later, and, though exposed to the whole tide range of the Atlantic, the tides are very weak and irregular, not rising more than at

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* See Boston edition, Vol. II, p. 225.

† Vol. xxviii, p. 8.

the Society Islands. On the southern coast of the United States, and at the island of Bermuda, in the Atlantic, it is high water about seven o'clock, the flood tide in the offing at the latter place *running to the northeast*. On the southern coast of Rhode Island and Massachusetts, it is high water from seven to eight o'clock. On the southeastern coast of Nova Scotia and Newfoundland, it is high water from eight to nine o'clock, the flood tide off the latter coast also running northeastwardly. At the Azores, or Western Islands, in lat. 38° N., near the middle of the Atlantic, it is high water about 12 o'clock, *and the flood runs to the eastward*.* Finally, it is high water on the western coasts of Ireland and Spain about two o'clock,—all on the same days. These statements are approximated from the American Coast Pilot, and other authorities, care being taken to avoid the retarding effects of local obstructions as far as possible, by timing from the most extraneous positions of coast, towards the open ocean.

Viewing these phenomena in connexion with some other facts, I was led to suspect that the great tide wave performes an actual circuit in each of the great oceanic basins, on both sides of the equator, passing *westwardly* in the equatorial latitudes, and returning *eastwardly* in the higher latitudes, above 25° or 30° N. and S., and analogous to the course which is pursued, as can be demonstrably shown, by the great *currents*, both of the ocean and the atmosphere. If such *be* the operation of the tides, certain regions in mid-ocean would form the foci, or neutral points, in these great elliptical circuits, and would be but slightly, if at all, affected by the ordinary tides. The elaborate investigation of cotidal lines in which Professor Whewell is engaged, will probably show whether this conjecture is well founded, or whether the course of the great tide wave be from the Southern Ocean, northwardly, through the entire length of the Atlantic, and in disregard of the direct lunar influence in this ocean, as would seem to be indicated in his late paper on that subject. The greatest difficulty attending the inquiry, is in procuring correct observations from those islands and external points of coast, which bear most decidedly upon the question; and whatever may be its results, I am happy to find that a course or method of investigation which has governed my own inquiries in meteorology, has been adopted on this kindred subject, by so able an investigator.

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* See Penny Cyclopedia; article, Azores.

The second statement objected to by the writer of the notes, that "in Peru, at the height of 18,000 feet, the wind has been found to be fresh from the south-west," was given on the authority of Samuel Curron, Esq., whose interesting narrative of his ascent to the Peak of Misté may be found in the Boston Journal of Philosophy and the Arts. vol. I, see p. 364–5. The authorities for the Sandwich Islands and Peak of Teneriffe, which were included in my statement, are also at hand; and I may add that the Rev. John C. Brigham, the present Secretary of the American Bible Society, in crossing the Andes, from Buenos Ayres to Chili, at the height of 17,000 feet, found the wind blowing strong from the west, as he has himself informed me.*

There are other facts which seem to indicate the prevalence of a southwesterly wind over the higher regions of tropical America, such as the fall of ashes, in 1812, at Barbadoes and elsewhere, from the volcano of St. Vincent; and the late fall of volcanic ashes at Jamaica, and other places, in January of the present year, which appears to be traced to the tremendous outbreakings of a volcano on the continent, near the Bay of Honduras.†

It is unfortunate that those who visit high mountains, so generally neglect to inform us of the direction of the wind in those regions. I have been led to suspect, however, that in some, at least, of the cases mentioned by me, those winds were occasioned by the diurnal influences of heat and cold upon the stratum of air *lying upon the inclined surface of the mountain.* This was first suggested by the statement of Mr. Brigham, who was informed by the natives that this wind blew only in the day time, and it seems not unlikely that most elevated peaks are subject to a similar influence. We have, however, far better evidence afforded us of the course of the higher strata, in the movements of the clouds at different altitudes, which should have been recorded more generally than has yet been done.

The fact appears, however, to be well established, that the great trade wind of the tropical latitudes does not prevail at any great altitude, nor does it usually cross any elevated region of country, to say nothing of its being arrested or deflected by its own gravitation

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* See Missionary Herald for 1826, Vol. xxii, p. 153–4, where the *direction* of the wind is not mentioned.

† The volcano of Consiguina on the shore of the Pacific ocean, distant eight hundred miles S. 62° W. from Kingston, Jamaica.—*Author.*

in mid-ocean, in the Indian seas, and on the bosom of the great Pacific. But to return to the only remaining position which is called in question by the author of the notes, and which is in the following words.

"'The regular semidiurnal variations of the barometer is at its maximum about 10, A. M., and at its minimum about 3, P. M.; at New York it is nearly the same; *but at Edinburgh, the effect is reversed, the minimum being at* 10, *and the maximum at* 3 *o'clock*,' &c. I was (says the writer of the notes) startled at this statement, and immediately began to look for authorities to confirm or refute it, when I happened on the following passage in the second report of the British Association for the Advancement of Science, p. 131."

This is followed by a condensed statement of the observations made near Edinburgh, by Professor Forbes, since 1827, which have been published at length in the Edinburgh transactions; from which it appears that near Edinburgh, in latitude 56°, the mean annual oscillation between 10, A. M. and 4, P. M., is .0106 inches; and that the St. Bernard observations, 8000 feet above the level of the sea, and those of Capt. Parry, in the Arctic regions, both indicate a true negative oscillation, &c.

I readily acknowledge a partial inaccuracy in my statement, which should have read, "but in high latitudes the effect is reversed," &c. the locality or latitude of Edinburgh not being that in which the negative oscillation is established; and the error was subsequently so corrected. It may, however, be proper on this occasion to explain the cause of the inaccuracy. A short time before I was called upon to sketch the facts in meteorology, to which the foregoing exceptions have been made, the paper of Professor Forbes, above referred to, had met my eye, under circumstances, however, which precluded its perusal; but in glancing over its pages, and the illustrations which accompanied it, I perceived that the Professor had shown a negative oscillation of the barometer, taking effect somewhere in the higher latitudes, and his extensive series of observations having been made near Edinburgh, I was led to infer that this conclusion, or result, had been directly deduced from these observations. Under this impression, I ventured to pen the statement in its original form, which I should not have done, however, unless I had at that time felt myself certain of an opportunity to give the paper of Professor Forbes a thorough perusal, before my statement should pass through the press; but the concurrence of an unlooked-for accident, with a more speedy publication than I had anticipated, prevented my design from being realized.

I have now given the authorities and explanations to which the author of the notes seems entitled, and it may not be improper to state, for the satisfaction of those who may have read my articles on the storms of the American coast,* that the method pursued by me in investigating the physical character of those storms, has been to procure a number of copies of clean charts of the Atlantic, and to map out all the facts which I was able to collect in relation to any one of these storms, upon one of these charts, in their true time and location, so as to obtain a connected view of these facts, both as regards their consentaneous and consecutive relations. The results have been highly satisfactory—so much so, indeed, that I have not met with the statement of a single fact which is at variance with the explanation which I have given of the operation of these storms, *except in two or three instances, which proved, on further inquiry, to have been erroneously stated.* The historical records of more than a century past have been freely resorted to, and the inquiry has also been extended to other coasts and seas, and has shown the existence of an unvarying system, which I have not yet attempted to describe, except in the most summary manner.

It may well be supposed that, in pursuing this inquiry by the method of a simple induction of particulars, as here stated, I have not been able to preserve an unshaken confidence in some of those "received theories," which appear to have been founded on vague generalizations, or unproved and untenable hypotheses; and I can hardly think that the reasonings which have at various times been adduced in support of these theories, from the time of Halley downards, can be deemed either conclusive or satisfactory by any unbiassed mind, that shall give them a strict and impartial examination.

The grand error into which the whole school of meteorologists appear to have fallen, consists in ascribing to heat and rarefaction the origin and support of the great atmospheric currents which are found to prevail over a great portion of the globe. Nor is it necessary to perceive, or point out, an adequate and undeniable physical cause for the production of these phenomena, before we can discover the inconsistency and fallacy of the reasonings by which the old system of meteorology has been supported. Such a cause, however, I consider *is* furnished in the rotative motion of the earth upon its axis, in which

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* American Journal of Science, vol. xx., p. 17-51; vol. xxi., p. 191-3; vol. xxv., p. 114-121.

originates the centrifugal and other modifying influences of the gravitating power, which must always operate upon the great oceans of fluid and aerial matter which rest upon the earth's crust, producing, of necessity, those great currents to which we have alluded.

I have long entertained this conviction, but do not remember to have seen this great physical influence recognised in any degree, in its application to this subject, except by Sir John F. W. Herschel, in the third chapter of his popular treatise on astronomy,* where, by the aid of this rotative influence, he has been able to give us the most imposing support of the received theory of winds which has ever appeared, and in which the connection of the trades with the returning westerly winds, is, with some exceptions, correctly developed. Sir John, however, has erred, like his predecessors, in ascribing mainly, if not primarily, to heat and rarefaction, those results which should have been ascribed solely to *mechanical gravitation*, as connected with the rotative and orbitual motion of the earth's surface, the influence of which he but partially recognizes in connection with this and another subject of inquiry. I may also add, that, had this able philosopher been fully conversant with the facts which relate to the *course* and other phenomena of hurricanes, he would probably have withheld the hypothesis which he has given in a note appended to the chapter which I have alluded to, although one of the principal suggestions in this note has, undoubtedly, a proper connection with the subject.

As I can but seldom allow myself to enter upon the discussion of these matters, the preceding suggestions may be taken for what they are thought to be worth by those under whose notice they may chance to fall; but, to prevent being misunderstood, I freely admit that heat is often an exciting, as well as modifying cause of *local* winds, and other phenomena, and that it has an incidental or subordinate action (though not such as is usually assigned) in the organization and development of storms, and that, in certain circumstances, it influences the interpositions of the moving strata of the atmosphere. Its greatest direct influence is probably exhibited in what are called land and sea breezes, or in the diurnal modifications which are exhibited by regular and general winds. But, so far from being the great prime mover of the atmospheric currents, either in

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* Art. 179 to Art. 200.

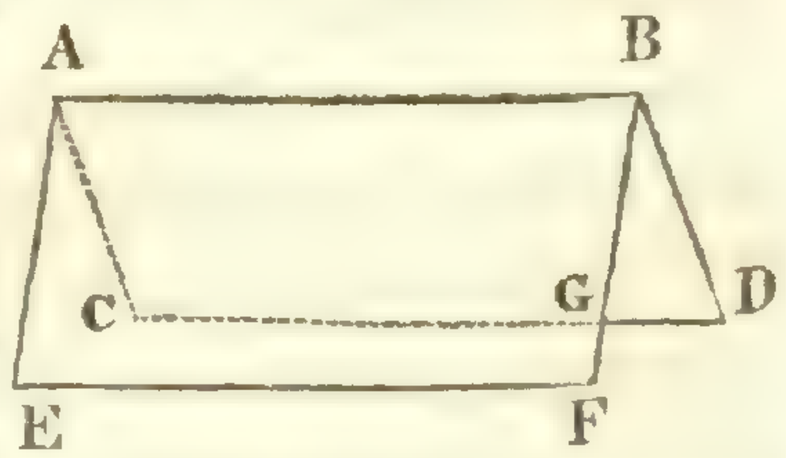
producing a supposed primary north and south current, or in any other manner, I entertain no doubt that, if it were possible to preserve the atmosphere at a uniform temperature over the whole surface of the globe, the general winds could not be less brisk, but would become more constant and uniform than ever.

New York, April 8th, 1835.

Art. XXII.—*On the Resistance of Fluids*; by Geo. W. Keely, Prof. of Natural Philosophy, in Waterville College.

TO PROF. SILLIMAN.

Sir—I perceive in No. 55 of the Journal, that Prof. Wallace has announced a new measure of the resistance of a fluid in a direction perpendicular to a plane surface moving in it: viz. That it is as the sine of the inclination of the plane. Permit me to state my reasons for adhering to the old doctrine, that the perpendicular resistance is as the square of the sine of inclination. It is well known that the latter measure has been deduced from the alleged facts that the *number* and the *force* of the resisting particles vary as the sine of the inclination. If it be true that the resistance to a plane surface moving in a fluid is as the number of particles it strikes in its course, and that the number of particles in any indefinitely thin fluid lamina is as the area of that lamina, (neither of which we think Prof. W. will deny,) it follows that, if BD be a section of a plane inclined to the direction BA of its motion, and BF an equal section of an equal plane perpendicular to the same direction, the number of particles BD will strike is to the number that BF will strike in the same time as the parallelogram ABCD is to the parallelogram AEFB; and the resistances are therefore, on this account, as BG is to BD, or as the sines of the inclinations of the sections; the resistances to the planes are of course in the same ratio.



Now this familiar demonstration would seem to settle the question; but Prof. Wallace argues, "that the number of particles striking the plane does *not* depend on the breadth of the fluid column BG BF, but *on the surface of the plane*, because the particles that act on the plane are those in contact with it, and therefore their

number is as its superficial area." Now admitting it to be true that the number of material particles in contact with the plane, at any instant, is the same, whether it be perpendicular or inclined to the direction of the motion, it does not, we think, necessarily follow that the number of particles struck in any given time will be the same. But neither is it evident that the number of particles in contact with the plane is the same for every inclination of the plane. The burden of proof, however, seems to lie with Prof. W. He has *assumed* the general physical fact that the number of particles in contact with the plane, at any instant, is the same for every position of the plane, and he has deduced an inference, not formally expressed, indeed, but surely implied, otherwise the argument is worth nothing, that the number of particles struck in any given time is as the number in contact with the plane at any instant. Now we think the fact and the conclusion may very safely be denied, and it becomes Prof. W. to shew that they are consistent with some hypothesis respecting the form and relative position of the ultimate particles of a fluid body. In any hypothesis, we believe the following positions will be found to hold:

First. Whether the number of particles, at any instant, in contact with the plane, in different positions, is the same, depends wholly on the hypothesis.

Second. If the number is the same in different positions, it will be found that the number of fluid strata struck in any given time is as the sine of the inclination.

Third. If the number is *not* the same then it varies as the sine of the inclination, and the number of strata struck will, in any given time, be the same.

If Prof. W. can devise any hypothesis with which these positions do not agree, we will allow he can disturb our belief in the truth of the law of the square of the sines.

The wide difference between the results of observation and those of the old theory, would tend rather to dissuade us from admitting the truth of the new, when we consider what important physical circumstances are and must be omitted in the conditions.

Waterville College, (Me.)

ART. XXIII.—*Experimental illustrations of the Radiating and Absorbing Powers of Surfaces for Heat, of the effects of Transparent Screens, of the conducting Powers of Solids, &c.*; by A. D. BACHE, Prof. of Nat. Philos. and Chem. Univ. of Penn.

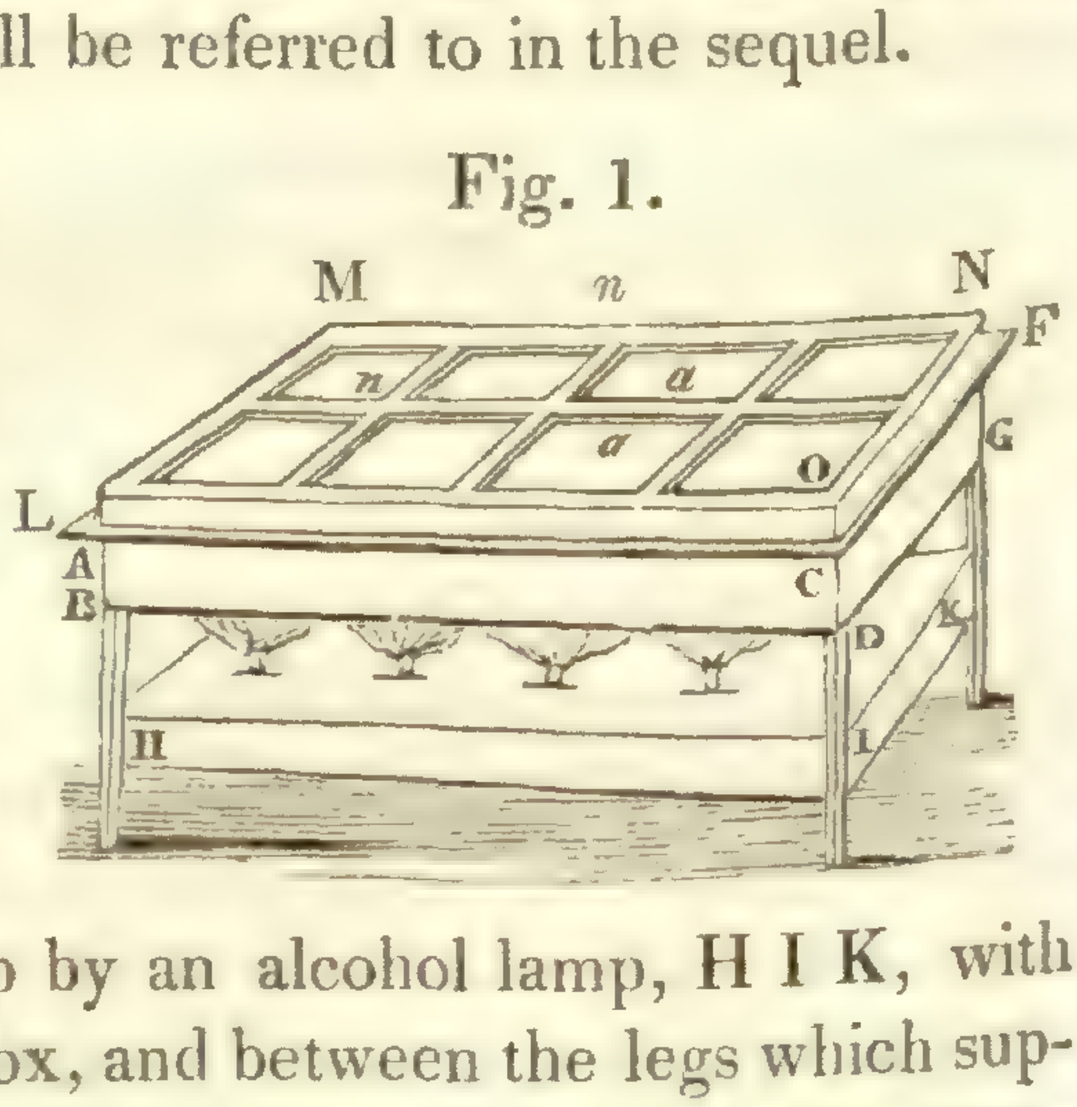
From the Journal of the Franklin Institute for May, 1835.

AMONG the very interesting phenomena of heat, there are many which are with difficulty brought under the the eyes of a class, so as to render them satisfactory to each one, by the test of sight. The thermometer, even when constructed on a large scale, affords but an inadequate means of rendering evident the temperature of bodies, to those who are distant from the lecture table, and the illustrations made by its use, are at best, rather tame. When the temperatures to be indicated admit of it, lecturers have, in preference to using the thermometer, resorted to the freezing of water, to the melting of wax, to the inflaming of phosphorus, the boiling of water, &c., as more adequate means of rendering evident the temperatures in question.

The instruments about to be described, I have found very convenient for class illustration, and always to afford satisfactory evidence of the positions to be proved. The first instrument is intended to show the powers of different surfaces in radiating and absorbing heat, with other phenomena, which will be referred to in the sequel.

To produce a sensibly uniform temperature, a prismatic vessel, A B C D F G, fig. 1, of sheet iron, of a convenient size, is filled with melted tin, and covered at top by a plate of sheet iron, A F, or, in preference, by a plate of cast iron, of moderate thickness. The temperature of the tin is kept up by an alcohol lamp, H I K, with several wicks, fitting below the box, and between the legs which support it; by this means, the top radiates heat of considerable intensity. I prefer the use of tin, in the box, to that of oil, on account of the greater cleanliness resulting from its use, and because the oil gives off at high temperatures an offensive vapor. Boiling water does not give a sufficiently high temperature to produce rapid action

Fig. 1.



in the apparatus, and the greater exactness with which it would yield a constant temperature, is not necessary in such an illustration.

A rectangular frame, L M N O, made of dry wood, to prevent its warping, of a small height, L A, and of a length and breadth such as to adapt it to its place upon the cover of the box, A G, is divided by cross pieces of wood into small squares, or rectangular compartments, as *n n*, the upper surface of the frame being perfectly plain, and parallel to the cover, A F, of the box containing the melted tin; this frame is intended to support, without the necessity of contact with each other, small plates of thin metal, or other appropriate material, the surfaces of which are variously coated.

To show the *radiating powers of different surfaces*, any convenient number of thin plates of sheet lead, or sheet tin, or mica, are cut to suit the size of the squares, *n n*, of the frame, overlapping the inner edges, but not extending to the middle of the small dividing bars of wood; each one of the plates has one of its surfaces differently coated; supposing them to be of lead, one is coated with lamp-black, another brightened by sand paper, or coated with tin leaf, another left tarnished, a fourth coated with gold leaf. Being placed upon the frame, as at *a*, *a*, with the coated sides uppermost, small bits of phosphorus are placed upon the middle of the plates, and the frame put in its place upon the cover, A F. The surfaces which absorb the heat radiated by the cover, A F, being the same, the material and thickness of the plates being the same, the circumstances are alike in each plate, except so far as the upper surface is concerned; the plate which is coated with the worst radiator, will become warm first, and the phosphorus will melt first upon it, and, generally, the order of melting of the phosphorus will indicate the inverse order of the radiating powers of the surfaces. As the heat radiated from the cover is high, the melting of the phosphorus will be soon followed by its inflaming, and the order thus given will hardly deviate from the first; the interference from the film of oxide, which is so annoying in the modification of the apparatus of Ingenhouz, for illustrating the relative conducting powers of bodies, is almost entirely obviated by the high temperature of the source of heat. To avoid injuring the coated surfaces, a thin film of mica may be placed below the phosphorus, the film being large enough to prevent the effect of the spreading of phosphorus, as it burns.

The plates should be made thin, in order that the result may be mainly dependent upon differences in the radiating power of the

surfaces. I have used plates of thin sheet tin, (iron coated with tin,) of sheet zinc, and of glass, with good effect. The effects may be accelerated by coating the under surfaces with lamp black to promote the absorption of heat; but in that case, care should be taken that the thickness is at least equal to that which produces the greatest amount of absorption.

Instead of the pieces of phosphorus, wax, or other readily fusible material, may be used, as in the apparatus of Ingenhouz; or cones of wood, weighted at the base, and kept upon the plate, with the vertex downward, by a fusible material, may be substituted.

It may happen that the lecture table is so arranged as to render it advantageous to incline the cover, A F, of the box, A G; this will be readily accomplished by making the cover, part of the box itself, in which case the melted metal may be introduced through a hole in the higher side; as, for example, in A D.

To illustrate the fact that *absorption and radiation are proportional*, the same square plates, *a a* &c., may be used; the variously coated surfaces are placed downwards, phosphorus is put, as before, on the upper surfaces, and the frame deposited in its place upon the cover of the box. The phosphorus will now melt in the inverse of the order shown in the first experiment, the plate having the best absorbent surface, heating first. If plates of metal be used, their upper surfaces should be bright, for this illustration; but glass, or mica, which will allow the coating to be seen through, is best adapted to the purpose.

The fact that the *radiation* or *absorption* of heat *does not take place merely at the surface*, but at a definite thickness, which becomes very appreciable in good radiators, may be satisfactorily shown by coating the surface of one of the plates with a thin layer of lamp black and another one with a considerable thickness of the same material. If the coatings be upwards as in the first illustration, the phosphorus will melt soonest upon the thinly coated plate; if the coatings be downwards, as in the second illustration, the reverse will be the case.

The *effect of transparent screens* in preventing the passage through them of heat not accompanied by light, may be shown by using, in the same instrument, plates of glass, mica, &c. of equal thickness; theoretically, the differential results are not as free from objections as the former ones; but the fact is illustrated almost unexceptionably since the phosphorus melts first at the surface of the plate, which it

would not do if the plate were cool, and the fusion resulted from the absorption, by the phosphorus, of the heat which had passed through the screen of glass, or mica.

These illustrations I have tried repeatedly, and successfully ; there are others of a more refined character, which I have not yet had an opportunity to attempt, but which, I doubt not, might be carried out very easily. The first of these is the curious property discovered in rock salt, by M. Melloni, of permitting the passage of heat of low intensity, as freely as that of high ; a piece of phosphorus placed upon the salt, and another upon a thin film of mica, the under surface of which should be coated with lamp black, just above the plate of rock salt, would serve to show this property. That transparent plates of mica are only partially diathermous, would be shown in a similar way, and, in fact, by the relative periods of fusion of the phosphorus just above the plate, and of that upon it, a notion of the relative quantities of heat stopped and transmitted, might be furnished.

Another illustration which I have tried with success, is that of the want of specific effect of color on the absorption of non-luminous heat; a fact which some researches, undertaken by Prof. Courtenay and myself, and not yet published, indicate. On coating the plates on one side with lamp black, plumbago, white lead, chalk, prussian blue, vermillion, &c., it will be found that the phosphorus melts upon them without regard to the order of color. Care should be taken that the thickness of the coatings is such as to give to them each the maximum radiating or absorbing power ; a thickness which will differ for each material, but which may, for all, be very easily exceeded.

By a change in the character of the plates, this instrument may be used to advantage in showing the experiments devised by Franklin, and executed first by Ingenhouz, for indicating the relative *conducting powers of solids* for heat.

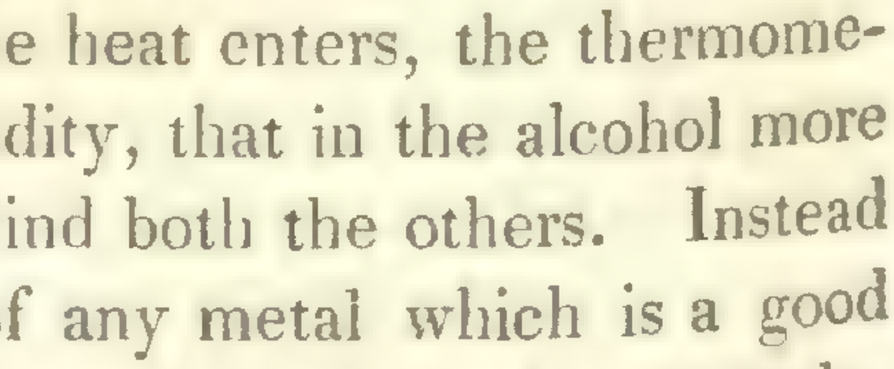
That the experiment just referred to does not truly give the relative conducting powers of bodies, can, I think, be clearly demonstrated, notwithstanding that it is found, in all the books, in juxtaposition with the very elegant and accurate method proposed by Fourier ; with the explanation of its intrinsic defects, it may be, however, still admitted as a general illustration. To apply the instrument, plates of the same thickness of the substances to be tested, as, for example, of tin, iron, lead, copper, pottery, wood, glass, &c., which can be easily obtained in the requisite form, are to be coated on both sides with a thick coating of lamp black, or

other good absorbent and radiator, leaving a small strip of the upper surface bare, to exhibit the nature of the material ; the plates having phosphorus placed, on mica, upon them, are put upon the frame, and this is placed on the cover of the box : the order in which the phosphorus fires, gives the same indication as in the apparatus of Ingenhouz. This effect is more rapid than when cones, or rods, are used, especially from the lower temperature of the substance which is commonly used as a source of heat. These remarks do not apply, of course, to the forms of that apparatus in which hot sand is used.

The second instrument to be described, is intended to show the common illustration of the fact that bodies have *different specific heats.*

Theoretically, this illustration is, I think, inaccurate, but is *admissible*, like the last ; upon this subject, I hope to be able, at a future time, to be more explicit ; at present, my remarks are confined to general illustrations. That different bodies require unequal quantities of heat to raise their temperatures through the same number of degrees, is illustrated upon equal weights, or bulks, by subjecting them, when at the same temperatures, to the same source of heat, and proving that they require different times to arrive at the same temperature. This idea is a fundamental one, and cannot too early be inculcated upon a learner. As an illustration, I have three vessels of sheet iron, to contain equal *weights* of mercury, alcohol, and water ; these are fastened to a frame, by which they can be dipped into the same vessel containing hot water. An alcohol thermometer, with a column of fluid large enough to be visible at a moderate distance, dips into each vessel. As the heat enters, the thermometer in the mercury rises with great rapidity, that in the alcohol more slowly, and that in the water lags behind both the others. Instead of those thermometers, if a cylinder of any metal which is a good conductor, and has a low specific heat, such as copper for example, should, after being coated with a varnish of thickened linseed oil to protect the surface, be introduced into each vessel, phosphorus placed on the top, would melt and inflame first on the metal which dipped into the liquid having the least capacity for heat. In the annexed cut, fig. 2, *a*, *b*, and *c*, are the vessels ; *d*, *e*, *f*, metallic cylinders resting in wooden, or metallic, or mica,

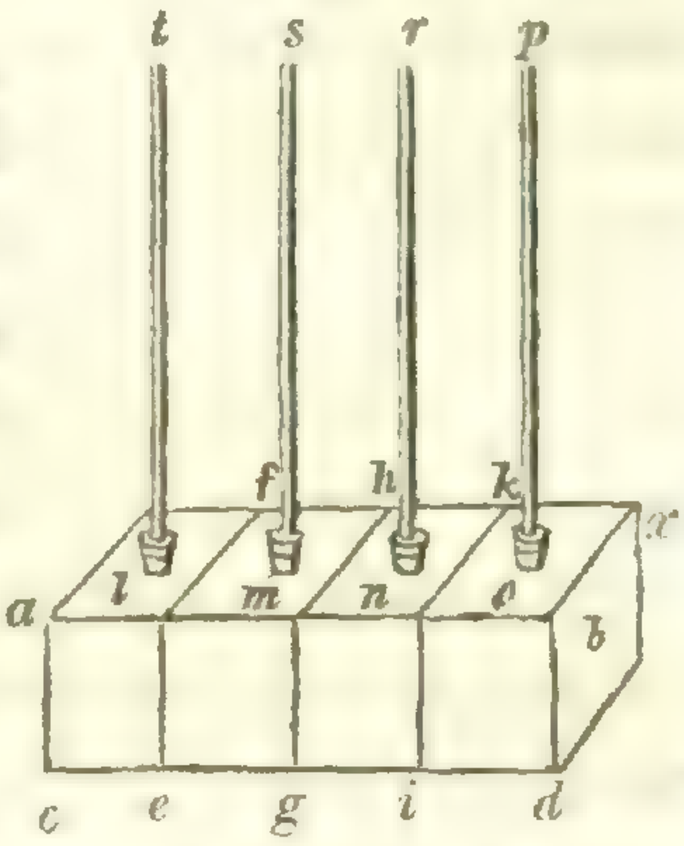
Fig. 2.



disks, and the whole dipping into a vessel, *m n*, of boiling water. The mercury is so small in bulk, that the influence of this strikes the student immediately; but the idea which he thus catches at, is refuted by the more tardy heating of the water, which is less in bulk than the alcohol.

Before the forms of illustration, of the radiation and absorption of heat, already described, had suggested themselves, I had contrived another apparatus, which gave very good results, and may be, by some, preferred to the one already described. A long box, *a b c d x*, of tin, was divided into compartments by partitions, *e f*, *g h*, *i k*, &c., and a top soldered upon each, having a conical opening, *l*, *m*, *n*, &c., to receive a cork, through which a tube, *o p*, *n r*, *m s*, *l t*, &c. passed; these compartments were made as nearly equal as possible, and the tubes entering them were selected of as nearly equal bore as possible; equal measures of colored water were poured through the conical openings into the several compartments, so as to cover the bottom to a depth regulated as will be presently stated. The tubes and corks were now inserted, and cemented; and each cell thus formed an air thermometer, the expansion of the air within driving the colored liquid up the tube entering the cell. That there might be no error from a want of equality in these thermometers, after bringing the liquid to a convenient height in each of the stems, by forcing air into each, or by dropping liquid from a dropping tube into the tube, the whole was plunged into a vessel of water, of a temperature sufficiently above the original temperature of the air within, to give distances on the tubes, readily divisible into equal parts of sufficient magnitude. These degrees were marked by a rude scale, formed by colored threads, tied around the tubes. One surface of the box was kept uniformly bright, or regularly tarnished, or coated; the other *a d*, was coated with substances of different radiating powers.

Fig. 3.

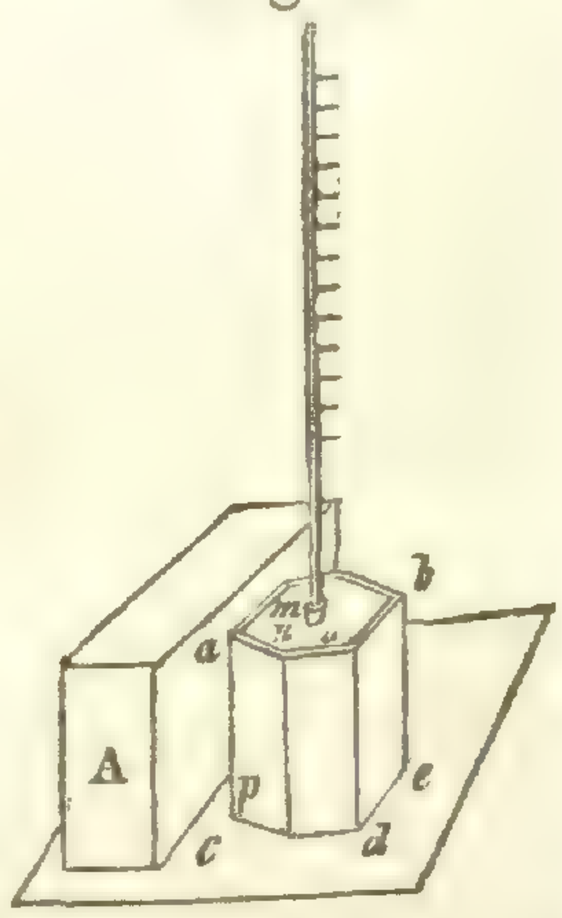


The box being placed with the uncoated side towards a vessel of warm water, the heat enters uniformly that side of the compartments, but is radiated differently from the opposite side, and the liquid from the air thermometers is urged more rapidly up those tubes which enter into the compartments radiating worst, and ultimately arrives at a greater height, showing a greater stationary temperature, or

temperature of equilibrium, between the heat absorbed, and that which is radiated. If the vessel be now turned, so that the variously coated surfaces are towards the source of heat, the liquid in those coated with the best absorbents, will immediately begin to rise in the tubes, and that in those coated with the worst absorbents, to fall. That the two lateral compartments are exposed to a greater cooling action than the others, may be an objection to this apparatus; but it is easily obviated, and with it the communication of heat from one compartment to another, by terminating the box at each end by a small compartment, and separating each of the other compartments by a similar space; in fact, convenience alone was the reason for uniting these air thermometers in one vessel.

Another form of apparatus, which is more simple, I have found convenient; but it occupies more time than that last described, in obtaining the same results. A prism of any convenient number of sides, is made into an air thermometer, in the manner described in speaking of the last apparatus; and the sides are variously coated; it fits loosely into a prism of the same form, but wanting one side; in the figure, *a b c e*, represents the eveloping surface, and *m n o p*, the air thermometer. To show the different absorbing powers of the different substances, the vessels described are placed as in the figure, before another, A, containing hot water, hot sand, or any other convenient source of heat. Suppose the side of the air thermometer which is the worst absorbent of heat, to be exposed to the source of heat, the air within is expanded, and the position of the liquid in the tube is marked by an index; a better absorbent is exposed, and the liquid rises higher; a worse, and it falls below its original level; the experiment can thus be varied at pleasure. The outer sheath, or covering prism, serves to render the surface, not exposed to the source of heat, uniform in its radiating powers, and to protect those sides which are not intended to be exposed to the source of heat, from the radiation of the vessel, A, which, otherwise, would affect them sensibly. If the air thermometer were a rectangular prism, of course the objection just stated would not apply; but the sheath would still be necessary to equalize the radiation from the surfaces not exposed to the source of heat.

Fig 4.



To show the radiating powers of the different surfaces, the sheath is turned so that the open side is exposed to the air; the absorption of heat now becomes sensibly constant, and the greater or less height of the liquid in the tube, is determined by the less or greater radiating power of the exposed surface.

The order in which the surfaces are exposed may, of course, be so arranged as not to require the temperature of the source of heat to be kept constant.

Such an apparatus, placed before a stove, would make an admirable illustration in a school, or a vessel of water, colder or warmer than the room, may be used as the radiating or absorbing body. For the tin vessel here described, a common square glass bottle may be substituted, without disadvantage. Even a common glass phial, made into an air thermometer by inserting a tube through a tight cork, into some liquid occupying the lower part of the phial, and provided with a movable coating of tin foil, gilt paper, writing paper, and paper covered with lamp black, when placed before a fire, or in a room of which the air is warm, when the external air is cold, brought near a window, will afford an interesting and instructive illustration.

Philadelphia, February, 1835.

ART. XXIV.—*Facts in reference to the Spark, &c. from a long conductor uniting the poles of a Galvanic Battery*; by JOSEPH HENRY, Professor of Natural Philosophy in the College of New Jersey, Princeton.

TO THE COMMITTEE ON PUBLICATIONS.

GENTLEMEN,—The American Philosophical Society, at their last stated meeting, authorized the publication of the following abstract of a verbal communication made to the Society, by Professor Henry, on the sixteenth of January last. A memoir on this subject has been since submitted to the Society, containing an extension of the subject, the primary fact in relation to which was observed by Professor Henry as early as 1832, and announced by him in the American Journal of Science.* Mr. Faraday having recently entered upon a similar train of observations, the immediate publication of the

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* Vol. XXII, p. 408.

accompanying is important, that the prior claims of our fellow countryman may not be overlooked.

Very respectfully yours,

A. D. Bache.

One of the Secretaries Am. Philos. Soc.

Philadelphia, Feb. 7th, 1835.

Extract from the proceedings of the stated meeting of the American Philosophical Society, January 16, 1835.

The following facts in reference to the spark, shock, &c., from a galvanic battery, of a single pair when the poles are united by a long conductor, communicated by Professor Joseph Henry, and those relating to the spark were illustrated experimentally.

1. A long wire gives a more intense spark than a short one. There is, however, with a given surface of zinc a length beyond which the effect is not increased; a wire of one hundred and twenty feet gave about the same intensity of spark as one of two hundred and forty feet.

2. A thick wire gives a larger spark than a smaller one of the same length.

3. A wire coiled into a helix, gives a more vivid spark than the same wire when uncoiled.

4. A ribbon of copper, coiled into a flat spiral, gives a more intense spark than any other arrangement yet tried.

5. The effect is increased, by using a longer and wider ribbon, to an extent not yet determined. The greatest effect has been produced by a coil ninety six feet long, and weighing 15 lbs.; a larger conductor has not been received.

6. A ribbon of copper, first doubled into two strands, and then coiled into a flat spiral, gives no spark, or a very feeble one.

7. Large copper handles, soldered to the ends of the coil of ninety six feet, and these grasped by both, one by each hand, a shock is felt at the elbows, when the contact is broken in a battery of a single pair with one and a half feet of zinc surface.

8. A shock is also felt when the copper of the battery is grasped with one hand, and one of the handles with the other; the intensity, however, is not as great as in the last case. This method of receiving the shock may be called the direct method, the other the lateral one.

9. The decomposition of a liquid is effected by the use of the coil with a battery of a single pair, by interrupting the current, and introducing a pair of decomposing wires.

10. A mixture of oxygen and hydrogen is also exploded by means of the coil, and breaking the contact, in a bladder containing the mixture.

11. The property of producing an intense spark is induced, on a short wire, by introducing, at any point of a compound galvanic current, a large flat spiral, and joining the poles by the short wire.

12. A spark is produced when the plates of a single battery are separated by a foot or more of diluted acid.

13. Little or no increase in the effect is produced by inserting a piece of soft iron into the centre of a flat spiral.

14. The effect produced by an electro-magnetic magnet, in giving the shock, is due principally to the coiling of the long wire which surrounds the soft iron.

Appendix to the above—on the Action of a Spiral Conductor, &c.; by Prof. Joseph Henry, Princeton College.

TO PROF. SILLIMAN.

With this I send you a copy of a paper communicated by me to the American Philosophical Society, on the influence of a spiral conductor in increasing the intensity of Electricity from a galvanic arrangement of a single pair. As the part of the transactions which contains the paper has not yet been distributed, I regret that I am not at liberty to request you to insert the article for more general diffusion in your valuable Journal. An abstract however of the principal facts was ordered to be published, and appeared in the March number of the Franklin Journal. A copy was also sent by Prof. Bache for insertion in the American Journal; but as it did not appear in the last number, you will confer a favor by inserting it in the next.*

Should you wish to repeat the experiments, you will find them most interestingly exhibited with one of Dr. Hare's Calorimotors. If a galvanic current of very low intensity, from this instrument, be transmitted through a spiral conductor formed of copper ribbon about one inch wide, from sixty to one hundred feet long, well covered

* Then mislaid, but now inserted, see above.

with silk, and the several spires closely wound on each other, the calorimotor will be almost converted into a deflagrator. One end of the conductor being attached to a pole of the battery, and the other brought in contact with, or rubbed along the edge of a plate of metal attached to the other pole, a vivid deflagration will be produced, even when the plates are immersed in a mixture containing not more than one part of acid to five hundred parts of water.

If a copper cylinder of about two inches in diameter, and four or five inches long, to serve as a handle, be attached to each end of the spiral by an intervening piece of copper wire and thin cylinders grasped with moistened hands, a series of shocks will be felt when one end of the conductor is drawn across the edges of the zinc plates, the other end being in contact with the copper pole.

Another method of producing the shocks, is to place the spiral between two batteries each of a single pair, so as to connect the copper of one with the zinc of the other. If the extreme poles of this compound arrangement be terminated by the copper handles, and these be brought in contact, holding one in each hand, a deflagration of the metal will be produced, and a thrilling sensation, scarcely supportable, felt in each arm. The effect is much increased if the handles are rough: two cylinders of cast zinc terminating the poles, were found to produce the greatest effect when rubbed on each other.

To exhibit these phenomena in a striking manner, a galvanic battery of considerable size is required. I have used one for the purpose, containing about forty feet of zinc surface, estimating both sides of the plate. This battery was first immersed for a short time in a strong solution of acid to dissolve the coating of oxide, and then removed to a vessel containing pure water. The small quantity of acid adhering to the plates was sufficient to produce, by means of the spiral the deflagration of the metals, which would shock and snap for many hours in succession, while with a short conductor the battery in the same state gave no signs of electricity.

This will be found an economical method of exhibiting some very interesting experiments with the calorimotor. After having shown the ordinary heating powers of the instrument with strong acid, transfer the plates to a trough containing pure water, and the action of the coil may be shown for an almost indefinite time, at little or no expense of zinc or acid.

The spiral produces no increased effect when applied to a galvanic trough of one hundred four inch plates. If, however, a coil of

five or six hundred feet of wire be substituted, an increase of action will be manifest. The length of the coil must be in some ratio to the projectile force of the electricity, and also the quantity to the thickness of the conductor, in order to produce a maximum result. Thus, when a small battery is used with a large conductor, it must be charged with strong acid.

The action of the spiral conductor depends on the inductive principle of an electric current discovered by Mr. Faraday, and is consequently intimately connected with the whole subject of Magneto-Electricity.

If a magnet be fitted up in the ordinary manner, with a spool of wire covered with silk around the keeper, the intensity of the shock will be astonishingly increased, if the current generated in the spool be transmitted through a coil of several hundred feet of fine wire surrounding the legs of the magnet. It is necessary, however, to produce this effect, that the wire on the spool, and that around the magnet, should at first form a continuous closed circuit, and that this be interrupted at the same instant that the keeper is detached, so that the induced current may pass entirely through the body.

The intense shock may also be given by generating a current with one magnet, and accelerated by passing it around a second magnet.

Professor Emmet, of the University of Virginia, more than two years since, made the interesting discovery that the magneto-electric current is much increased in intensity by passing it through a portion of the generating magnet. This interesting fact, which he has applied with much success, to improve the magneto-electric machine, may undoubtedly be referred to the same cause as the action of the spiral, and I have succeeded in modifying the application of it in several ways.

These magnetic experiments were made on the first or second day of May last, while on a visit to Philadelphia, with the large magnet belonging to the museum, and kindly loaned me by Mr. Peal for the purpose. They were made with the assistance of my friend Mr. Lukins, but as I have not had an opportunity of verifying them, I cannot at present give a more detailed account. I have also made some preparations for applying the same principle to increase the action of a thermo-electric current.

Art. XXV.—*Volcanic Eruptions and Earthquakes.*

1. *Eruption of the Volcano of Cosiguina*,—communicated for this Journal by Col. Juan Galindo.

TO PROFESSOR SILLIMAN.

Rio Mopan, April 13th, 1835.

Sir—One of the most stupendous convulsions of the globe ever known in this hemisphere took place last January, on the eruption of the volcano of Cosiguina.

This volcano is situated in Nicaragua, one of the states of Central America, and stands near the Eastern promontory of the bay of Conchagua, separating the waters of the gulf from the Pacific.

I can give no more faithful or vivid description of its appearance and effects in the immediate vicinity, than the following translation of a report, dated January 29, from the commandant of Union, a sea port situated on the western shore of the bay of Conchagua, and the nearest place of any consequence, to the volcano.

"On the 20th inst.—day having dawned with usual serenity—at 8 o'clock, towards the S. E., a dense cloud was perceived of a pyramidal figure, preceded by a rumbling noise, and it continued rising until it covered the sun, at which elevation, about 10, it separated to the north and south accompanied by thunder and lightning: the cloud finally covered the whole firmament, about 11, and enveloped every thing in the greatest darkness, so that the nearest objects were imperceptible. The melancholy howling of beasts, the flocks of birds of all species, that came to seek, as it were, an asylum amongst men, the terror which assailed the latter, the cries of the women and children, and the uncertainty of the issue of so rare a phenomenon—every thing combined to overcome the stoutest soul and fill it with apprehension, and the more so when at 4 P. M., the earth began to quake and continued in a perpetual undulation which gradually increased. This was followed by a shower of phosphoric sand, which lasted till 8 P. M., on the same day, when there began falling a heavy and fine powder like flour; the thunder and lightning continued the whole night and the following day, (the 21st) and at eight minutes past 3 P. M. there was so long and violent an earthquake that many men, who were walking in a penitential procession, were thrown down. The darkness lasted forty three hours, making it indispensable for every one to carry a light, and even these were not sufficient to see clearly with."

"On the 22nd it was somewhat less dark, although the sun was not visible and towards the morning of the 23d, the tremendously loud thunder claps were heard in succession like the firing of pieces of artillery of the largest calibre, and this fresh occurrence was accompanied by increased showers of dust."

"From day dawn of the 23d until 10 A. M., a dim light only served to shew the most melancholy spectacle. The streets, which, from the rocky nature of the soil, are full of inequalities and stones, appeared quite level, being covered with dust. Men, women and children were so disfigured that it was not easy to recognize any one except by the sound of their voices or other circumstances. Houses and trees, not to be distinguished through the dust which covered them, had the most horrible appearance, yet in spite of these appalling sights, they were preferable to the darkness into which we were again plunged from after the said hour of 10, as during the preceding days. The general distress, which had been assuaged, was renewed, and although leaving the place was attended by eminent peril from the wild beasts that had sallied from the forests and sought the towns and high roads, as happened in the neighboring village of Conchagua and this town, into which tigers thrust themselves; yet another terror was superior, and more than half the inhabitants of Union emigrated on foot, abandoning their houses, well persuaded that they should never return to them; since they prognosticated the total destruction of the town, and fled with dismay for refuge to the mountains."

"At half past 3 on the morning of the 24th, the moon and a few stars were visible, as if through a curtain, and the day was clear although the sun could not be seen, since the dust continued falling, having covered the ground all round about to a thickness of five inches."

"The 25th and 26th were like the 24th, with frequent though not violent earthquakes."

"The cause of all this has been the volcano of Cosiguina, which burst out on the 20th. I am also informed that on the island of Tigre in that direction, the showers of the 21st were of pumice stones of the size of a pea, and some are even as large as a hen's egg: the earth quaked there more than here, but no houses or other edifices have been thrown down."

"Here there are many people with catarrhs, head-aches, sore throats, and pectoral affections, resulting doubtless from the dust:

several persons are seriously unwell, and yesterday a girl of seven years old died with symptoms of an inflammatory sore throat.—Flocks of birds are found dead, lying in the roads, and floating on the sea."

"The showers of dust lasted till the 27th."

The following is an extract from a letter of my own, dated February 7.

"Still in total ignorance respecting the place of the supposed volcanic eruptions of last month, I can only state my own former mistaken conjectures respecting them, and others of the same class to which they gave rise throughout Central America."

"Near Salamá, the chief place of Verapas, being on the road from Guatemala to the port of Isabal, I distinctly heard, on the night between the 16th and 17th of January, continued noises similar to those always produced by volcanic eruptions; however there was something peculiar in these sounds, often resembling the discharge of single large guns."

"On the night of the 22d, I was sleeping on the banks of the Polochic, about sixteen leagues before arriving at Isabal. I suppose that near eleven o'clock the apparent firing began; the guns were heard at regular intervals. Both myself and all my men had been constantly accustomed during our whole lives to hear volcanic eruptions in all parts of Central America, yet for some hours we were every one without a doubt that the noise was produced by artillery, and that it proceeded from the direction of Isabal."

"I could not but conclude that an action was taking place in that port; I then again, reflecting on the improbability of such an event, raised a conjecture that the commandant, in some extraordinary state of inebriation, was celebrating his installation, his birth day, or some other event: I slumbered and pondered on, still more completely puzzled by the long continuance of the firing."

"Towards day-light certainly the noise was confused, and more resembling ordinary volcanic eruptions; yet I resumed my boat journey down the river with considerable doubts on my mind, and the first canoe I met coming up the river, I ordered to be obliquely questioned as to the state of Isabal, and though the appearance of the men in it was that of fishermen, I had some ideas that they were soldiers in disguise, and that their arms were concealed in the bottom of the boat; other travellers however, subsequently dispelled all my doubts."

"I observed nothing remarkable in the atmosphere or appearance of the night of the 22d, and no ashes, such as I have since heard fell in other places; neither were ashes seen in Isabal, and the inhabitants there supposed a volcanic eruption had taken place in some mountain to their south. In Omoa they had the same idea. In Trugillo showers of ashes fell, and they also supposed there that the sound proceeded from some mountains due south of them."

"In San Salvador, the federal city, the eruption was supposed to have been of the volcano of San Vicento, a day's journey to the east; the heart of the indigo country was said to be destroyed, and forty thousand inhabitants to have perished."

"Subsequent accounts have shown the fallacy of all these conjectures."

In Leon, the capital of Nicaragua, the noise of the night of the 22d was accompanied by a violent earthquake, the following day was dark, and the ashes that fell formed a layer nine inches thick: however, the loss of seven lives, and the ruin of two farms in the immediate neighborhood of the volcano, have been the only damage done by it in that state.

Persons at some distance from Quesaltenango, supposed the eruption proceeded from the volcano near that city. The noise in that direction is known to have been heard as far as Oajaca.

At the port of Balize in the bay of Honduras, the British authorities there were doubtful whether the firing of the night of the 22d proceeded from a man of war in distress, or a naval action; in case of the first, the superintendant ordered the guns of the fort to answer. In the interior of the settlement of Balize, the inhabitants universally believed that it was myself attacking their port with a Central American force.

At Peten, to the westward of Balize, it was likewise supposed to be myself at the head of an independent insurrection in the British settlement.

At Kingston, and the other southern ports of Jamaica, where the sound was heard, it was supposed to proceed from the British man of war Fly, cast on the Pedro bank: however the ashes which subsequently fell, convinced the observers in Jamaica that a volcano was the origin.

At Santamartha in New Grenada, it was supposed to be the firing of the same vessel in distress: the noise was heard as far as Bogota.

Captain McQuay, who commanded the Fly, was in the harbor of

Carthagena, and accompanied the governor of that port in a reconnaissance, both fearing that the firing proceeded from some vessel in want of succor.

Finally, every where the noise was supposed to proceed from the immediate vicinity.

In addition to the above, an official communication from the city of Nacaome describes the pyramidal cloud on the summit of Cosiguina at half past 6, A. M. It seemed of many hues and great density and at some height separated into two parts, one spreading over the summit of Conchagua, and the other towards the peak of Perspire. Here the ground and buildings were covered to the depth of seven or eight inches with fine dust and coarse sand in which were found birds of all kinds suffocated. Some quadrupeds from the forest, sought shelter in the town, and the rivers filled with the volcanic substances, cast upon their shores an innumerable quantity of fishes in a torpid state and some dead.

A letter from Omoa speaks of the earthquake and of several eruptions by which were wholly submerged three large towns and several petty villages with parts of the ports of St. Miguel and St. Salvadore. Five of the eruptions had continued for eight days, and scattered rocks, stones and cinders in all directions to the distance of sixty leagues. One of them burst forth within twenty miles of Truxillo, and another occurred near Balire."

The volcanic agency seems to have operated on an extensive scale, and to have had vent in a great number of places, and the country from Bogota about $4\frac{1}{2}^{\circ}$ N., 74° $14'$ W., throughout the whole isthmus, certainly as far north as Balire (more than one thousand miles) was convulsed or affected by the concussion.*

2. *Earthquake in Chili, Feb.* 20, 1835.

The accounts received through commercial sources, of this earthquake, are so remarkable, that we shall give a pretty full abstract of their contents.

One of the most terrific and destructive convulsions with which this devoted country has ever been visited, commenced on the 20th of February, 1835—occasioned, as is said by the eruption of the volcano of Antuco, in about the latitude of Conception, and about thirty leagues from the coast. The first and most disastrous shock occur-

* The terror of the inhabitants at Alancho (anticipating the approach of the judgment day) was so great, that three hundred of those who lived in a state of concubineage, were married at once.

red on the 20th of February at about half past 11, A. M., and the shocks continued to occur three or four a day, up to March 6th, and even as late as March 17, a shock was felt at Valparaiso, which was sensible to the shipping and on land.

The first shock was felt from Valparaiso, Lon. 71° 38′ 15″ W., Lat. 33° 0′ 30″ S. to some distance south of Conception, Lon. 73° 5′ W., Lat. 36° 49′ 10″ S.,—and from the Cordilleras, to the Island of Juan Fernandez, more than three hundred miles from the coast, where it was felt with most tremendous violence; the sea at the anchoring ground retiring to such a distance, that where there had been twelve fathoms of water, the ground was laid bare, and soon after returning with such fury that it completely destroyed the town and covered it with a deposit of mud several feet thick—the governor and garrison saving themselves by fleeing to the heights.

It is a matter of history, that between the years 1520 and 1752, five great earthquakes occurred in Chili. That on the 15th of March, 1657, destroyed a great part of the city of Conception which was founded by Valdivia in 1550, and was then the capital of Chili—now only of a jurisdiction—that on the 18th of June, 1730, drove the sea against the City of Conception, and overthrew its walls; and that of May 26th, 1751, completely destroyed that city, which was again inundated by the sea, and levelled with the ground all the fortresses and villages lying between lat. 34° and 40° S. The shocks continued at intervals more than a month. Not an individual human life, however, was lost on this occasion except some invalids, who were drowned in Conception. In 1751, Conception was rebuilt on the north side of the river Biobio, about a league from the sea—only to be again in 1835 destroyed and its population of 25,000 compelled to flee to the mountains and groves, and look back upon the place of their late habitation of which *only a single house* remains standing—and not another within leagues around.

Talcahuana, the port of Conception, lat. 36° 42′ 21″ S., lon. 73° 39′ 12″ W. was shaken down by the first shock, which lasted about 4½ minutes—after about 15 minutes the sea retired from the coast, about a mile, leaving the vessels aground, and then rolled in with a wave from twenty five to thirty feet high, deluging and entirely devastating the whole town—two successive inundations followed and in their reflux swept away and buried all the fragments and ruins, in fact every vestige of the place.

The scene during the first shock was appalling. The trembling of every thing around—the boiling of the sea, as when water is heated over a fire—the mountains and valleys rolling like the waves of the sea as far as the eye could reach, and producing in the inhabitants the same sensations as sea sickness—the earth opening wide, giving forth the most terrific moans, and laboring with internal fires, the sight at a distance, of the awe-stricken Catholics, fleeing, they knew not whither, for safety—buildings tottering in every direction,—and now whole blocks of brick dwellings rock from their foundation. In their fall they meet others, and all, as if locked in death, sink, with a tremendous crash, into the gaping earth, leaving no trace of their existence save memory, and the smoke and ashes which arise from the confusion, then the violent rushing of the waters over the ruins of a thickly populated town, sweeping the wrecks of the demolished habitations of the rich and poor, into one common chaos of ruin, was calculated to impress the mind of the beholder with wonder and astonishment.

The sea rose thirty feet above its ordinary level, and drove into the town-square the national bark Mapocho, and placed other vessels in imminent danger. On the 22d, a large portion of the island of Caracana, at the mouth of the bay, was swallowed up. The road from Talcahuana to Conception is almost entirely destroyed by the deep fissures and sloughs which have been created; consequently the destruction of property and the interruption of the channels of intercourse which facilitate the subsistence of a town, must be alarming.

The condition of the people who formerly inhabited spacious and convenient dwellings, where now not even a brick is left to mark the spot, is one of the utmost suffering. The poor people who lived in the country in small reed-huts have suffered but little.—Their houses withstood the shocks, and to them is preserved a roof for shelter. Those who fled to the hills, erected little shantees, on the spots of land least broken up, and were compelled to be constantly at work procuring the food necessary to satisfy hunger. It is a most fortunate thing for the people of the country, that the shock came at mid-day. Had it taken place in the middle hour of night, they would have been compelled to flee for safety without even the one suit of clothing they now have, making their sufferings much greater. Then the circumstance that the inhabitants have no other shelter than the groves, and the approaching cold season, which at Con-

ception commences in April by heavy rains, will aggravate the calamity, unless it should cause an almost universal emigration to the central Provinces of the Republic.

The movement of the earthquake was not so violent as it was long continued. The shock came from a S. E. course, prostrating every thing in its way, spreading its ravages throughout the provinces of Conception and Maule, and devastating nearly the whole of the southern portion of the Republic.

Conception, Talcahuana, Penco, Tome, Arauco, Colcuro, Pemuco, Yumbel, Rere, Los Angeles, La Florida, Coelemu, Ranquil, Cauquenes, San Carlos, Quirigue, Chillan, Talca, Arredan, Congas, Erras, Peural, St. Carlos, Vailoga, and other towns of both Provinces, have been ruined in consequence of that terrible event. Talcahuana, Penco and Tome were thrice inundated by the sea, and in Arauco and Colcuro it rose to the walls. In the port of Constitucion also, it rushed back and forth several times, and stranded the national schooners Juana and Jertrudis.

The number of lives lost, so far as ascertained, was four or five hundred; but it was supposed the actual number was much greater.

The loss of lives in Conception does not exceed fifty odd; in Talcahuana, very few.

At San Juan de Dios, some bricklayers who were at work when the earthquake came on, almost all perished. Children and grown persons have alike disappeared from the number of the living, and in short, the whole presents a scene of deplorable calamity.

From twenty five to thirty towns, beside many small villages between Conception and the Cordilleras, were scenes of complete ruin. From four to five hundred lives were lost just in that section of country—but the extent of the suffering is not yet known—probably thrice that number have been buried in the ruins.

A new cathedral, building in Conception, which they say has been more than fifty years in building, has scarcely one stone left upon another, and in its fall buried twenty workmen in its ruins.

Effect of the Earthquake at Sea.—On the 20th of February, (the day that Conception and the places around were destroyed,) Capt. Townsend, in the ship Nile of this port, was cruising for whales on the coast of Chili, in lat. 39° 15′. He felt the shock so sensibly that the spars and rigging over his head shook in such a manner that it was dangerous to stand under them. Thinking that the vessel had run aground, he immediately wore ship and hove the lead, but

finding no bottom with twenty fathoms of line, concluded it was an earthquake. On a subsequent visit to Talcahuana, his suspicions were confirmed, in the desolation and ruin which that once thriving port, then presented; as also in the fact, that the water in the bay was five or six feet lower than its usual depth. Talcahuana has been the general resort of American whale ships for several years past—the harbor being one of the best on the coast. The town is situated almost on a level with the sea, large hills rising in the rear. Capt. T. states that he has been on the coast of Chili a number of voyages during the same month, and thinks he never knew such a scarcity of whales, fish, and fowls, as in the present year. It is the general opinion that the earthquake has had a tendency to drive them from the coast. The shock was very sensibly felt by Capt. Cotton of ship Loper, six hundred miles from land.—*N. Bedford Gazette.*

3. *Earthquake at Florence.*

Early in March several shocks of an earthquake were felt at Florence, which seemed to shake the houses to their foundations. These shocks were preceded by the most furious winds and hurricanes.—*Atheneum, April* 28, 1835.

Vesuvius.—On the evening of the 2d of April, there was another explosion of Vesuvius. The shocks were so violent that the five craters vanished, and were all united to one frightful abyss. Immense masses of rock were projected to a vast height, and fell like a tremendous shower on the ribs of the mountain.

ART. XXVI.—*Notice of the posthumous work of the late Colonel Mark Beaufoy, entitled, "Nautical and Hydraulic Experiments, with numerous Scientific Miscellanies—in three volumes, with plates. Vol. I."*

WE have already mentioned the publication of the first volume of this splendid work by Henry Beaufoy, Esq., son of Col. Mark Beaufoy. We are indebted to a friend for the following memoranda, which we trust will prove interesting to our readers.

As Col. Beaufoy was a zealous and disinterested laborer in the service of mankind, the following *Notice of his Family* may form a proper introduction to a brief notice of his posthumous work.

The father and mother of Col. Beaufoy belonged to the respectable society of Friends, and lived on the south side of the Thames, opposite to the centre of the city of London.

Their eldest son, Mr. *Henry Beaufoy*, had a seat in the British House of Commons early in life; and remained a member of it during several parliaments, being often the chairman of a committee.—Having been educated in part among the English Protestant Dissenters, he conducted for a time the concerns of these dissenters in parliament; but his motion for a "Repeal of the Sacramental Test Laws" failing, Mr. Fox afterwards became their parliamentary leader. Henry Beaufoy was very active also in forming the association established in London in 1788, for *Promoting Discoveries in the Interior parts of Africa;* and he even by general consent, compiled their Memoirs; and in fact was usually employed to engage the persons who travelled in their employment. He was the first also who made the now celebrated Ledyard known in the United States, though Ledyard was a native of those states.* Mr. Henry Beaufoy was twice married, but he left no child.

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* The account of Ledyard, as collected from Ledyard himself and from Mr. Beaufoy, is picturesque and interesting in a high degree. (See Mr. Beaufoy's Memoir, published in 1790.) Mr. Park also, in his publication, quotes and confirms Ledyard's well known *general* remark on the superior sympathy of women towards strangers in distress, when compared with men. He even does more; for without noticing the application of the fact, he confirms the fact *by his own personal experience.* He had been refused admittance by men into various houses, and perhaps the caution on the part of some of these men had a natural foundation. But towards night, when the wind blew hard, and rain threatened, and wild beasts were soon to be expected to make their appearance; a woman passed by him, and seeing his distress, bid him follow her; and gave him not only shelter, but food, and a mat to sleep upon. In the mean time, one of the female attendants of the woman sang over Park an *extempore* song, to which other female attendants joined in the chorus; and the tenor of the song, which was precisely adapted to the case, and to the state of the weather, abundantly proves, that the feelings which Ledyard and Park had noted in their remarks, were *habitual* in the parties. Mrs. Barbauld has beautifully versified the *whole* of what *Ledyard* affirmed as to women in the *Evenings at Home*—while the well known duchess of Devonshire not only put the song applied to the case of Park into English verse, but got it set to pleasing music by an Italian composer, and she even added a verse to the song. (See Park's Travels, p. 263 and p. 198, with the annexed postcript, second edition, in 4to. 1799.)

It may be noticed here, to show the danger of error in *geographical conjectures*, that Major Rennell, who had arranged a map of the broader parts of the African continent to Mr. Beaufoy's Memoir, added a *fresh* map of the same territories to Mr. Park's Travels, with a memoir joined to the latter, in which he says that Mr. Park's authority, founded on ocular demonstration, sets the question *for ever* at

A sister of Mr. Henry Beaufoy's, it is believed, (but not with certainty,) was married to a member of the British House of Commons.

Col. Mark Beaufoy was a younger brother of Mr. Henry Beaufoy; and having had a scientific education, joined to an enthusiastic character, he pursued many scientific objects; of which only one, however, will here be noticed.

A particular incident having led him in his youth to attend to *Hydraulics and Naval Architecture*, he kept this object always in his view, from perceiving that his countrymen attended little to these matters, except *practically*. The French, on the other hand, he knew, had recourse to *theory*, as laid down by their own mathematicians, with the admirable Euler and a few others to help them; and had modelled their navy accordingly; also had led Spain to do the same; the English on their side making no further progress in the art, than such as arose from observing the *models* of some of the French and Spanish prizes which they had captured. In 1791, however, Col. Beaufoy, with some others, strenuously labored to establish a society in London, for the improvement of naval architecture, where THEORY should be formed on the basis of *experiment*. The project was adopted, and the Duke of Clarence, then an admiral, but now William IV, became President of the Society; and it was hoped that useful results would arise both to the vessels of war and commercial shipping of the nation by means of the plan.

In pursuance of this design, a committee was appointed to conduct a regular series of experiments; *Greenland dock* being chosen as the scene of their operations. This large dock was a private establishment, and by its large dimensions was well suited to the object; but it was not conveniently situated, since it lay two miles on an airline to the east of the south end of Westminster bridge, and most of the members of the society and of the committee, resided *beyond*

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rest, by determining the course of the great inland river of Africa, generally understood by the name of Niger, to be from *west to east*. Unfortunately a second journey of Mr. Park into Africa, proved this decision of Maj. Rennel to be founded in mistake; for a conclusion opposite to that of Major Rennel may be drawn from Mr. Park's *own later* discoveries, as well as from the evidence of the Lander's, Capt. Tuckey, and others. (See Appendix to Park's Travels, as above, p. 4 and 5.)

*this bridge.** The result was, that the experiments had few to attend them, besides Col. Beaufoy, (who had the chief direction of them,) and that finally Col. Beaufoy had himself to bear the chief expense of them. He was always, however, assisted by two or three able men; (among whom was Mr. Garnett, an English gentleman well known in this country;) and a regular register was most faithfully kept of all that was done. The *first volume* of the publication noticed in this article, comprehends the whole account of these experiments at Greenland dock, the number of which was, in the course of six years, between nine and ten thousand; and we are not surprized to learn that Earl Stanhope, one of the vice presidents of the society, was at times present.

Of Col. Beaufoy, individually, we may assert that he was peculiarly qualified for *experimental researches*. He was active, indefatigable, cautious, and exact; he spared no expense necessary to accomplish his objects; and knowing the *wants of mankind*, and the *searching nature of experience* in the hands of those who were to follow him, he constantly combined in his views *utility*, and a *faithful statement of facts*. Others might deceive *themselves* in consequence of what he related, while *he* was determined never to deceive *others*.

But we have not yet done with the notice of Col. Beaufoy's family. The colonel's wife was a remarkable person, and a real *helpmate* to him in all things, as will appear from the following account given by her son Henry, (who is the editor of the work forming the subject of this article.) "For some years (says Mr. Henry Beaufoy, junior,) the *calculations* [that is, respecting the above experiments] were made at Col. Beaufoy's residence at Hackney-Wick, by himself, assisted by his wife, who contributed no inconsiderable share to the progress and success of the experiments; for * * * (being a woman of considerable talent and scientific attainments,) * * * she was a good mathematician and practical astronomer, familiar with all the details of the observatory, the calculation of eclipses, &c.; and by method and strict economy of her time, (while

* Greenland dock is connected with the river Thames on the west side of the *Peninsula*, falsely called *Isle of Dogs*. This peninsula (or Isle of Dogs) has on the *north* (where its opening lies) Lime-house, Poplar, and Blackwell; and on the south we find Greenwich and Deptford.

the domestic arrangements proceeded with perfect regularity,) she was never at a loss for leisure in her husband's pursuits. * * * She died in 1800, at an early age, after an illness of a few hours; an irreparable loss to her husband. He survived her twenty-seven years, and proved the sincerity of his attachment by not marrying again. A few hours before he died, he spoke of her with emotions which shewed that time had not made the smallest diminution in his affection." To this account of Mrs. Mark Beaufoy, it must be added, that this remarkable couple left behind them sons and daughters.—Of their son, Mr. Henry Beaufoy, junior, we have now to say a few words.

This gentleman having received a good education, profited by it so as to be very useful to his father in his pursuits; and his father in consequence bequeathed to him his manuscripts. He is a member of the Royal Society of London, has ascended in a balloon with philosophical views, but (one instance only excepted) he is believed never to have appeared much as an original author. He seems contented, for the present, with being the *editor* of his father's works, which is a task full both of labor and responsibility; this however is not the precise place to enlarge upon this topic.

The work before us is printed at the Editor's *private press*, and is given to the public. At one period the first volume (namely, that now distributed) had cost £3000 sterling. It may be supposed that a smaller number than fifteen hundred copies would have more than sufficed, for distribution of a work of this nature; but although this may be true as regards the two *first* volumes, the volume of *miscellaneous papers* may require the number of copies now printed; and objections may have occurred against printing the work in broken parts. It may also be supposed, that the work might have been printed in a less expensive form; but experience has shown, that works splendidly printed and bound, are those which are most carefully preserved. This fact was known to that eminent distributor of books, Mr. Thomas Hollis, a gentleman who had a kindred desire to disperse knowledge, with the Beaufoy family, and who often in the books which he gave away, wrote the words *Ut spargam*, (that I may *spread* knowledge,) adding to this nothing more than T. H., the initials of his name.

It is proper to close this notice of the Beaufoy family, by saying that Mr. Henry Beaufoy, junior, is believed to be, like his grandfa-

ther, a *brewer ;* and we shall explain in a note the respectable nature of this trade, as it exists in the city of London.*

Opinions of Col. Beaufoy's work by very able judges. The first letter is from one of our best engineers, and was directed to the person from whom he had received the work of Col. Beaufoy for examination.

TO ————.

Boston, February 18, 1835.

Dear Sir—I have examined, with great satisfaction, the splendid work of Col. Beaufoy, published and presented to the Academy, by his son Henry Beaufoy, Esq.

The experiments detailed in this work are amongst the most important that were ever made in the subject to which they relate. The only account of them, which has heretofore existed, in the volume of the Society for the Encouragement of Naval Architecture, is not to be found in any library in this vicinity, and the publication of the work of Col. Beaufoy, which is much more full than the So-

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* The respectability of many commercial persons in London, is universally acknowledged throughout Europe and the U. States; but it is not so generally known that large *wholesale brewers* stand among the foremost of these characters. The reason is evident. The brewing trade in London, when on a large scale, requires a very enormous capital, and yet the chiefs in a brewing house are under no necessity of watching the details of the business; these details being simple and purely mechanical, and alloted to the care of subaltern persons. In proof of the respect in which some of the chiefs of these establishments are held, we have to observe (to refer to no other examples) that Messrs. Whitbread (father and son) were both brewers, and both members of parliament; and that the younger Mr. Whitbread was married to a sister of Earl Grey, who became premier of England, and that Mr. Whitbread, jun. was of some influence with his party in the House of Commons. To go no farther: the late Mrs. Thrale, the well known friend of Dr. Johnson, was the wife of a great brewer; and it is believed that it was on the floor of one of Mr. Thrale's great brewing vessels, it was said that a hundred persons could be seate', Another of those great establishments had a *cellar* which penetrated into the earth two stories deep, *in order to receive within its walls* a mass of beer to ripen during a whole season; and George III, king of England, at the period when this cellar was empty, descended to its bottom by a stone stair case, confined by an iron railing. Independent of the large and costly premises of the great brewers, with their carts and horses, and their utensils, the proprietors of these great establishments found it expedient to have at their command (either by purchase or lease) *public houses*, the tenants of which sell in them, none but the beer of their landlords. In short, great capitals, great gains, and a perfect independence as to attention to the details of the business, make this an eligible species of establishment among persons of great capital, who have no objection to appear in commercial concerns in a commercial country.

ciety's volume, gives us possession of the knowledge of a mass of facts, ascertained by most laborious and ingenious experiments, of immense value to every person engaged in hydraulic engineering.

I cannot but hope that Mr. Beaufoy will continue the publication of the other volumes, thus increasing the debt which is already due to him from practical men as well as from scientific investigators.

I am dear Sir, with great respect,
your obedient servant.

The second letter is from a gentleman much distinguished for his theoretical and practical knowledge of mechanics.

TO PROFESSOR SILLIMAN.

Dear Sir—I have with much pleasure given the first volume of Col. Beaufoy's work a cursory examination. The Resistance of Fluids, to which this volume chiefly relates, is a subject of great intricacy, and one in which I have felt a deep interest. I had given it sufficient attention, theoretically, to satisfy my own mind fully, that what is said on the subject in the works, commonly received as scientifical and practical text books is not at all to be relied upon, and was pursuing my inquiries for something more satisfactory, when I was referred by a friend to this volume, which, on my application, you were so kind as to lend me.

Before Col. Beaufoy commenced his experiments, the labors of philosophers and mathematicians in this department of hydraulics, had been chiefly directed to the deduction of a theory, a priori from the received doctrine of the percussion of fluids; and had for the most part contemplated only that portion of the resistance, which results from the direct or oblique action of the fluid on the anterior disc of the moving body. Some experiments had been tried, but they were comparatively few in number, and having been instituted for the purpose of confirming some point in the theory, were shaped with sole reference to that object. Attempts, also, had been made to deduce the law of resistance directly from experiments; but the experiments were so few and so little diversified, that such an attempt could proceed only upon the false assumption that the resistance is a *single force*, or if made up of several forces, that these have a fixed relation to each other.

Col. Beaufoy regards the resistance as made up of three distinct quantities, having no necessary dependence upon, or relation to each

other, viz. 1. The increased pressure on the anterior disc of the moving body, arising from its motion. 2. The diminished pressure on the posterior disc. 3. The friction of the fluid on the surface of the body.—By the application of a novel and curious process of analysis, he has most ingeniously contrived to separate this resistance into these three constituent elements, and to examine the value and efficiency of each in numerous and distinct classes of experiments. This mode of viewing and treating the subject will at once commend itself to every one who has given his attention to this department of hydraulics.

These experiments of Beaufoy have developed a vast number of facts which are of great value *in themselves considered*,—yet this value is scarcely appreciable, when compared with that which they possess as indices pointing to those *general principles*, the development of which was the ultimate object of all his labors. With reference to this object he has collated and classified his experiments with great care and judgment, and doubtless they will eventually become the basis on which will be erected a theoretical superstructure worthy of so magnificent a foundation.

I look with great interest for the "Tentamen Theoriæ Resistentiæ Fluidorum Constituenda" of Assessor Lagerhjelm, promised in a future volume.

Very respectfully yours,
ELI W. BLAKE.

New Haven, Conn., June, 1835.

ART. XXVII.—*Descriptions of some Shells, belonging to the Coast of New England*; by JOS. G. TOTTEN. No. 2.

Genus *Anatina*, Lam.

A. papyratia? Say. Plate, Fig. 1, *a*, *b*, *c*, *d*.

Shell, subovate, moderately convex, thin, fragile, valves nearly equal, gaping, not widely, at the posterior margin: *beak*s, not prominent, placed at about one third the length of the shell from the posterior end: *surface*, finely wrinkled concentrically, white, somewhat pearly, covered with a yellowish-white epidermis: *dorsal margin*, straight, behind the beaks: *posterior margin*, also straight, forming obtuse angles with the dorsal and posterior-basal margins; a slight wave, extending from the beaks to the lower angle, forms an indis-

tinct arcuation in advance of the angle: remaining portions of the contour quite regularly rounded: *teeth*, small, curved forward, pointing toward the anterior-basal margin, and supported, in each valve, by a thin and elevated rib: muscular and palleal impressions very indistinct.

Length, 0.64 of an inch.
Height, 0.50 do.
Thickness, 0.28 do.

There is reason to believe, that a larger size is sometimes attained. Smaller individuals have rather greater proportionate length.

Inhabits muddy bottom, Newport harbor, R. I. Obtained by the dredge from a depth of about fifteen feet. The ossiculum of this species, Fig. 1, *d*, (two views of the same enlarged) is small but stout: it is attached, anterially, by the ligament, to the spoon-shaped teeth.

On comparing the figures above referred to, with shells in the Philadelphia Museum, referred to by Mr. Say, Mr. Conrad is of the opinion, that this is the A. papyratia. In deference to this authority, and inclining to the same opinion, I affix Mr. Say's name—giving the figures because, as I think, no figure has been given by Mr. Say. At the same time, I am bound to remark that, in some particulars, the description published by that naturalist, (see Journal of Nat. Sciences, Phil., Vol. II, p. 314) does not well agree with our shell. He says, for instance, of the *papyratia*, "one valve very convex," while in this, the inequality of the valves is scarcely perceptible—and he gives a greater proportionate length ("width" of Say) than I have ever noticed amongst ours. Should this prove a different species, I suggest the name of A. *fragilis*.

Genus *Astarte*, Sow.

A. castanea? Say. Fig. 2, *a*, *b*, *c*, *d*, *e*, *f*.

Variety B.

Shell, sub-oval or sub-orbicular, length not exceeding the height, thick and heavy, inequilateral, with prominent beaks: *umbones*, rather convex: *disk*, with minute concentric wrinkles, deeper on the posterior slope, and a few obsolete undulations: *epidermis*, brownish-yellow, generally quite light, sometimes with a few darker zones: *cartilage-slope*, curved: *posterior margin*, sub-truncated: *lunule* and *corselet*, excavated and lanceolate: *within*, white, sometimes with a faint bluish tint: *cavity*, rather small; *inner margin*, regular-

ly crenulated in some adult specimens—in the younger, perfectly smooth. Of large specimens, length, 0.90 of an inch.

Height, 1.00 do.

Thickness, 0.50 do.

The proportions vary; but of more than twenty individuals, that which had least proportionate altitude, (Fig. 2, *e*.) had less length than height.

Found on the beach of Provincetown harbor, (Mass.) in company with A. *Castanea* of Say.

As the propriety of separating this shell from Mr. Say's, A. Castanea may be doubted, I now give it as a variety. In the form and arrangement of the teeth, it certainly differs but little, if at all: still, from a comparison of many specimens, it is believed that it will always be distinguished, by the lighter color of its epidermis, by its outline, and other less marked differences. The principal figures in the plates (*a*, *b*, *c*, *d*,) represent a shell with rather more than the average elevation, but not so much as other individuals in my possession, see *f*. Should this prove to be a different species, it may have the name of A. *procera*.

A. Danmoniensis, Sow. and others. Fig. 3, *a*, *b*, *c*, *d*.
Venus Danmoniensis, Montague, Dill, &c.
V. Crassatella, Blain.
Crassina Danmoniensis, Lam.

I give figures, that a comparison may be made between the European and American shells of this species.

As the crenulation of the inner margin is often made a specific characteristic, it may be interesting to notice that, in this species, as in the preceding, our young, and half grown, shells, have their margins perfectly smooth. The epidermis is very adherent, beautifully glossy, and varying in color, from light greenish-yellow, through yellowish-brown, to dark chesnut-brown.

Inhabits gravelly bottom, Newport harbor, (R. I.) obtained by the dredge from deep water.

Comparing this shell with the figures and descriptions of the books and with a European specimen in the cabinet of Lt. Harwood, I was at once convinced that it was A. Danmoniensis, but supposed it was now first found on the coast of the United States; Mr. Conrad, however, informs me that a valve from the Eastern coast, always considered the same as the British species, has been many years in Mr. Hyde's cabinet.

Genus *Bulla*, Lin.

B. insculpta. Fig. 4.

Shell, small, white, very thin and fragile, pellucid, oval, impressed at top, regularly rounded and widest below; with many slight longitudinal wrinkles, a few obsolete longitudinal waves, and very numerous equal, straight, impressed, revolving lines: *spire* none; in lieu thereof, a pit, not deeper than the origin of the right lip: *aperture*, of nearly equal width for one third of its length from the top, thence, downward, gradually expanding to a considerable breadth: *right lip*, regularly arched, sharp, rising from the axis, with a regular curvature upward and forward, higher than the shoulder of the shell: *left margin*, above, a thin plate glued upon the convexity of the second turn, below, rolled into a kind of spiral pillar which is twisted around, and at a little distance from, the imaginary axis of the shell. *Axis*, void to the summit, where it is closed by the common origin of the two margins: no proper *umbilicus*, but a slight chink under the recurved plate which forms the pillar.

Length, 0.35 of an inch.
Breadth, 0.23 do.

Inhabits muddy bottom in Newport harbor, (R. I.) Dredged in about fifteen feet of water.

This can hardly be Say's B. *solitaria*, (Journal of the Academy of Nat. Sciences, Phil., Vol. II, p. 245.) It is not, umbilicated at top, as that species is; having merely a shallow pit in which nothing of the interior whirls can be seen. The *solitaria* is described as being "narrowed at the base;" but though our shell is regularly rounded in the passage, below, of the right into the left margin, it is widely rounded; and the widest part of the shell is below the middle.

B. oryza. Fig. 5.

Shell, very small, white, glossy, not very thin, translucent, elliptical, symmetrically diminishing upward and downward from the middle—the base being rather acute and the summit depressed into a shallow pit: *surface*, with numerous longitudinal wrinkles, a number of impressed revolving lines on the lower portion, and a few more obscure revolving lines near the shoulder—none of these wrinkles or lines being visible without a magnifier: *aperture*, narrow at top, and gradually widening toward the base: *right lip*, regularly arch-

ed, sharp; above, originating behind the axis of the shell, and rising a little higher than the shoulder: *left margin*, above, a thin plate glued upon the convexity of the second whirl, below, thickened and formed into a stout and glossy pillar which is twisted on the axis of the shell: an oblique fold exists at the junction of this pillar with the convexity of the whirl, and, as the pillar does not reach the base of the shell, its somewhat abrupt truncation has the appearance of an obtuse tooth: *umbilicus* none: an interior callus strengthens the junction of the right lip with the top of the shell, and, from the greater opacity of this portion, seems to strengthen the whole interior of the shoulder ridge.

Length, 0.15 of an inch.
Breadth, 0.10 do.

Inhabits muddy bottom in Newport harbor, (R. I.) Dredged from a depth of fifteen feet.

Genus *Natica*, Adanson.

N. immaculata. Fig. 6, *a*, *b*, *c*.

Shell, small, milk-white, immaculate, glossy, longitudinally sub-oval: *volutions*, about five: *suture*, not impressed: *upper whirls*, very slightly convex: *umbilicus*, rounded, scarcely modified by the callus: *callus*, not very copious, and, entering the aperture under the upper part of the right lip, runs to the apex, causing a white spiral line to appear on the exterior surface, just under the sutures: *aperture*, rather narrow, regularly and somewhat acutely curved at the base: *operculum*, horny.

Length, 0.28 of an inch.
Breadth, 0.22 do.

It probably attains a somewhat greater size.

Inhabits Newport harbor, (R. I.) Dredged from deep water.

This shell, in form, much resembles Say's N. triseriata, (Jour. of Acad. of Nat. Sciences, Phil. Vol. v, p. 209) and is found associated with it. It is distinguishable from that species, however, not only by the broad difference of color, but by the lesser convexity of the upper whirls, and by the aperture, which is narrower near the base, and not sub-angular at the bottom of the pillar, and also by the operculum, which, is more elongate and has a smaller spire. Fig. 6, *b* is the operculum of *triseriata*, and *c* that of the *immaculata*.

Genus *Turritella*, Lam.

T. interrupta. Fig. 7.

Shell, small, subulate, brownish: *volutions*, about ten, almost flat, with about twenty two transverse, obtuse, ribs, separated by grooves of equal diameter, and with about fourteen sub-equal, impressed, revolving lines, which are arranged in pairs, and entirely interrupted by the ribs: below the middle of the body whirl, the ribs become obsolete, and the revolving lines continuous: *sutures*, made quite distinct by a slight shoulder to each volution: *aperture*, ovate, angular above, regularly rounded below, about one fifth the length of the shell: *right lip*, sharp, indistinctly sinuous.

Length, 0.22 of an inch.
Breadth, 0.07 do.

Inhabits Newport harbor, (R. I.) Obtained by the dredge.

This shell resembles in some respects the *Turbo elegantissimus* and the *Turbo simillimus* of Montague—the *Turritella æqualis* of Say, and the *Turritella laqueata* of Conrad, but, besides other differences, none of these are described as having the interrupted revolving lines of this species.

Genus *Cerithium*, Brug.

C. reticulatum. Fig. 8.

Shell, small, turreted, oblong-conical, having a granulated surface from the crossing of longitudinal obtuse ribs, and prominent spiral striæ: *ribs*, about twenty, soon becoming lost below the middle of the body whirl, and presenting distinct rows of granules on the spire: *spiral striæ* about six on the penultimate and antepenultimate whirls, five on the next above, and gradually lessening in number to the apex, very rarely with any intermediate smaller striæ; the spiral row of granules next below the suture, rather larger, and forming a slight shoulder to the volutions; about six, raised, revolving lines, obsoletely granular, below the middle of the body whirl: *volutions* about nine, slightly convex above the body whirl: *suture*, impressed: *aperture*, oblique, sub-ovate, acutely angular above, widely rounded below, less than one third the length of the shell: *labium*, concave: *labrum*, slightly waving in accordance with the ridges and valleys of the striæ, and not thickened: *canal*, a little recurved.

Length, 0.28 of an inch.
Breadth, 0.10 do.

Inhabits Narraganset roads, (R. I.) and Boston harbor, (Mass.)

This is undoubtedly the same shell that was described by me in this Journal, Vol. xxvi, p. 369, and named *Pasithea nigra.* I had then before me several hundred individuals, all living, from the length of 0.15 of an inch down to less than 0.10 of an inch, and did not suspect that all were immature. I was, however, much puzzled by its characters, and could find no place for it elsewhere, than in Mr. Lea's new genus *Pasithea.* I am now indebted to Dr. A. A. Gould of Boston, (through the kind agency of the Rev. F. W. P. Greenwood) for the means of making this correction, as well as for the intimation that I had been occupied with the young, only, of the species. The change in the form of the aperture of this shell, with increasing maturity, is interesting. While quite young, it might be considered a Turbo; and Dr. Gould states that it was regarded, by some, as the *Turbo calathiscus* of Montague, and so catalogued: Mr. Greenwood suggests that it may be Say's *Turritella alternata*, and the half-grown specimens agree pretty well with Say's description of that species; and in the state in which I described it, the future well marked beak and canal are indicated only by a scarcely perceptible arcuation at the base. The shell described by Say in "American Conchology, No. 5," as C. *ferrugineum* bears a resemblance to this; but his description does not accord with some marks which appear to be constant in our shell. I take pleasure in affixing the name suggested by Dr. Gould.

ART. XXVIII.—*Improved Air Pump Receiver, exhibited before the New York Mechanic's Institute, Jan.* 1835; by JOHN BELL, Member of the Institute.

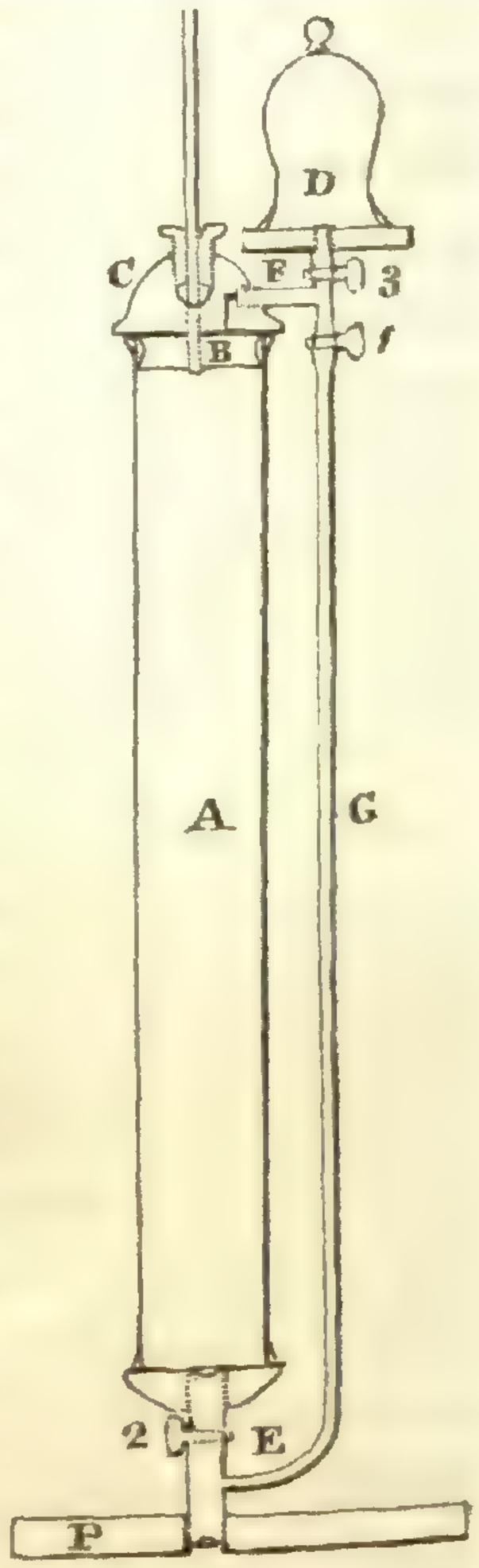
TO PROFESSOR SILLIMAN.

Dear Sir,—I send you herewith the drawings and description of an apparatus for creating a more perfect vacuum, than can usually be obtained by the common or silk-valve air pump. It is the invention of Mr. John Bell of this city, and is the subject of a paper by that gentleman recently read before the Mechanic's Institute of the city of New York, by which body I am requested to forward to you the description and drawing of the apparatus, that if you deem them worthy, they may find a place in your valuable Journal.

Yours, &c. L. D. GALE,

Cor. Sec. Mechanic's Institute of the City of New York.

"The accompanying drawing represents a metallic cylinder A, which is to be connected with P, the plate of a common air pump by means of a screw, and the vacuum is to be made in the receiver D. B, is a piston well packed, and fitted to move up and down in the cylinder; C, a stuffing box through which the piston rod passes air tight; E and F, metallic tubes of small bore communicating with the air pump plate P, the cylinder A, and the receiver D.



"Having screwed the apparatus upon the plate P, open the stop cocks 1, 2, 3, and exhaust the air within the receivers, in the usual way until the elasticity of the air within, is no longer capable of raising the valves. Then closing the stop cock 1, force the piston B, nearly to the bottom of the cylinder, by which the air before occupying the whole of the cylinder is so much condensed that its elasticity will raise the valves of the air pump and is by it removed. The air which before depressing the piston B, filled only the receiver D, is now expanded so as to fill also the cylinder A, while the piston B remains at the bottom of the cylinder, close the stop cocks 3 and 2, and then open 1 and elevate the piston by the hand to near the top of the cylinder. The air which before elevating the piston occupied the whole spaces of the cylinder is now compressed into that, occupied by the bore of the tube E, G, F and a small portion of the upper part of the cylinder and has now acquired sufficient elasticity to raise the valves, and by working the pump, as before, is removed. Thus by elevating the piston B, and exhausting, and then depressing it and exhausting, provided the apparatus be well made it is believed that the most perfect vacuum can be formed, equal for all practical purposes to the torricellian. The size of the cylinder A, may be increased to any dimensions, and the rapidity of the exhaustion will be in the same proportion."

The above apparatus it must be remembered is intended only for such pumps as have their valves raised by the elasticity of the air

within the receiver, and does not consequently apply to the pumps with metallic valves. It is not supposed that a person who should purchase a new pump, would obtain one of the common kind and have the "improved receiver" of Mr. Bell attached to it; but while he has in his possession an instrument of the former kind, he may render it equal in the effects produced, to those with metallic valves, by attaching to it the receiver of Mr. Bell. It is not supposed or intended that the above receiver should be used in performing the common air pump experiments, that require only a partial vacuum, but that it should be confined to those where a more perfect one is necessary.

MISCELLANIES.

FOREIGN AND DOMESTIC.

1. *Oxy-hydrogen illumination.* C. U. S.—M. Jose Roura, Professor of Chemistry in the University of Barcelona, sent a letter to the Royal Academy of Paris, suggesting an improvement in the oxy-hydrogen illumination of Capt. Drummond, by substituting the sulphate of lime for the carbonate; the former is powdered, mixed into a paste with some gum, and then cut into small pieces; the jet of oxygen and hydrogen upon it produces a most brilliant light, sulphurous acid and water are disengaged, and oxide of calcium remains. M. Arago observed that the French light-house commission were engaged in effecting a similar plan of illumination; after some experience, it was proved that the light emitted was equal to that of twenty thousand Argand lamps, but this intensity is not constant, because the heat soon hardened the lime so as to require frequent removal or snuffing, to allow the flame to operate upon the fresh particles; another inconvenience is, that the light produced by a luminous body of such small dimensions as a cylinder of lime can have but a very slight divergence, and when upon the horizon, its appearance at each point from a revolving light would be almost instantaneous, so that navigators may fail in perceiving it. and be unable to discover the situation of the light house.—*Atheneum, Nov.*

2. *Singular preservation of Life in a Molluscous Animal.*—M. Rang, Member of the Royal Academy of Sciences of Paris receiv-

ed four young specimens of Anodonta rubens, Lam., from Senegal, and although they had been enveloped in cotton for two months, they were still alive; he had learnt that these animals live eight months of the year out of water, upon the ground suddenly abandoned by the river, and that they remain during six of these months exposed to the ardent heat of the Senegal.—*Idem.*

3. *Isomerism.* J. G.—The differences in chemical and mechanical properties among simple and compound bodies, were the first to attract the attention of the early chemists. When methods were discovered in more recent times by which the elements of compound bodies could be separated from each other, it was natural to expect that those which were possessed of unlike properties should also prove unlike in composition. Nor did the results of analysis disappoint this expecta ion. It was found that substances differing in properties were composed either of unlike elements or of the same elements in unlike proportion, and if results of a contrary character were at any time obtained, they were at once set down as erroneous, and further research generally proved them so. But as the art of analysis improved, and the chances of error were confined within narrower limits, the views of chemists in regard to the composition of bodies became more extended. The vast variety of organic compounds which Nature, by her mysterious processes of elaboration, has formed out of the same four simple elements, taught them that the characteristic properties of different compound bodies depended less on the presence of unlike elements than had hitherto been supposed. The near approach to equality in the proportions of the elements of many widely different vegetable products, showed them how closely substances might stand to each other in composition, while they were far separated in properties; and when at length it was proved by convincing experiments, that the elements may be the same and their proportions identical, and yet different compounds result, it became necessary to recognise the mode of grouping or arranging these elements, as alone sufficient to produce the most striking sensible differences. This last conclusion was first distinctly pointed out by the compounds of carbon and hydrogen; it has been confirmed and established by many more recent investigations.

Until lately the atomic weights of compound substances containing the same elements in the same relative proportion were always found to differ, and in this difference there appeared still a sufficient reason for their unlike nature.

It was conceivable that in bodies differing as to their atomic constitution in this one point only, the elements might be more or less condensed, or otherwise so differently grouped as to give rise to the observed difference in their properties. But the progress of the science has removed this distinction also, and made us acquainted with instances in which like elements grouped together in like number and proportion, constitute unlike compounds having the same atomic weight.

Dr. Dalton, in his reasonings on atomic arrangement, had early shown that the atoms of compound bodies might be supposed to group themselves in one of several different ways. Berzelius in 1814 had proved, by his experiments on Tin, that there existed two chlorides and two oxides of that metal, having the same atomic constitution but possessing unlike properties; and Dr. Thomson in his *First Principles*, in treating of the then supposed identical composition of the acetic and succinic acids, has made it exceedingly probable that there did actually exist very unlike chemical compounds in which the same elements in the same relative proportion were so grouped together as to produce the same atomic weight; but it was not till the appearance of an admirable paper by Berzelius, on the composition of the Tartaric and Paratartric (Racemic) Acids, that the doctrine was fully established. In this paper he showed that these two acids on the one hand, and the phosphoric and paraphosphoric on the other, are identical in composition, and for such bodies he proposed the term *Isomeric* (ισος *equal*, μερος *part*). The able and interesting researches of MM. Wöhler and Liebig on the acids of cyanogen, added to the list, by showing that the soluble and insoluble cyanuric acids $\frac{3}{2}$ (Cy+2O+H); the cyanic and fulminic acids were also isomeric.

Many other examples have since been brought forward, and the investigation of organized compounds is daily adding to our knowledge on this important subject. The doctrine itself has likewise met with general reception; and in adverting to the enlarged ideas it has already given birth to, we cannot help regarding the establishment of it as a new bound the science has taken towards that vast extension it is destined to attain.

4. *Water, maximum density of.* J. G.—The question as to the temperature at which the density of water is a maximum does not seem to be yet quite settled. Deluc first fixed it at 40° Fah.;

Sir Charles Blagden and Mr. Gilpin reduced it to 39°; Dr. Hope's elegant method gave 39.5°; Biot, in his Tables gives by calculation, 38.156°; and the French, in fixing their standard weights and measures, adopted 40°. More lately, the elaborate researches of Hällstrom fixed it at 39.38°, in which determination great confidence was placed. Prof. Stampfer, of Vienna has renewed the investigation with the adoption of new precaution.

His method was to weigh a hollow cylinder of known bulk, made air tight, at about 66° Fahr., in water of different temperatures; and to insure accuracy, he continued his weighings during a whole year, so as to have the temperatures of the water and surrounding air nearly alike. From a great number of results carefully corrected, he deduces 38.75°, for maximum density. Muncke also has made experiments on the same subject, and found water to have a maximum of 38.804°. The cause of differences so great must be determined by further investigations, the thermometers are the most likely source of error; for though Erman has shown that a very minute admixture of a saline substance would cause an important difference in the temperature of maximum density, we cannot suppose such experimenters to employ water that had not been several times distilled.

Mr. Crichton of Glasgow, by employing a thermometer tube with a large bulb filled with water and allowing for the expansion of the glass, has more recently arrived at a determination agreeing very nearly with those of Muncke and Stampfer. The true point of maximum density he fixes at 38.97° Fahr. consequently that at which water acquires *the same absolute magnitude as at* 32°, *is* 45.94°.

5. *Gallic Acid.* J. G.—Döbereiner obtains pure gallic acid in a few minutes by the following process. A concentrated decoction of gall-nuts, mixed with a little acetic acid to decompose the gallate of lime is shaken for one minute with a quantity of ether. The gallic acid is taken up by the ether, and by spontaneous evaporation on a watch glass is obtained in small colorless prisms. If longer digested, the liquid separates into three portions. The lightest contains the gallic and acetic acids, if the latter be present in excess; the next an ethereal solution of tannin; and the heaviest, *the water and extractive matter.*—*Report of British Association.*

6. *Acetic Acid.* J. G.—A most important improvement has recently been introduced into the manufacture of vinegar, which is al-

ready extensively practised on the continent. The introduction of this improvement is chiefly due, I believe, to Mitscherlich. It is founded upon the principle that alcohol, by absorbing oxygen, is changed into acetic acid and water. For, two alcohol + four oxygen =one acetic acid + three water (6H + 4C + 2O) + 4O = (3H + 4C + 3O) + 3 (H + O.)

This oxidation is promoted by the process of fermentation; and when the fermentation has begun, is much accelerated by the presence of acetic acid. The oxidation is effected entirely at the expense of the oxygen of the air:—to accelerate the process, therefore, by producing as many points of contact as possible between the liquid and the air, the following arrangement is adopted. A large cask is taken, placed upright with a stop cock at the bottom and a series of holes, half an inch in diameter, bored one in each stave, a few inches above it. It is then nearly filled with chips or shavings of wood, previously steeped in strong vinegar till they are perfectly saturated. Within the upper end of the cask a shallow cylindrical vessel is placed, nearly in contact with the shavings, the bottom of which is perforated with many small holes, each partially stopped with a slender twig which passes an inch or two beneath the perforated bottom of the cylinder. The alcohol diluted with eight or nine parts of water, and mixed with the fermenting substances, is now poured into the cylinder, through the bottom of which it trickles, drop by drop, upon the shavings below, becomes oxidized in its passage, and runs out at the stop cock beneath, *already converted almost entirely into vinegar.* The air rushes in by the holes beneath, and passes out above by eight glass tubes, cemented for that purpose into the bottom of the cylinder; and so rapidly is it deprived of its oxygen, when it escapes above, that it extinguishes a candle. During the process much heat is also developed; so that from the temperature of 60° (that of the room,) the interior of the cask rises as high as 86° F. In the proper regulation of this temperature, much of the difficulty consists.

A second transmission of the acid, thus obtained, through another similar cask, finishes the process. The whole is concluded in a few hours, four and twenty is considered amply sufficient to convert a given quantity of alcohol into vinegar.—*Idem.*

7. *Opium.* J.G.—Few substances have undergone more repeated investigations than opium, or been subjected to more varied chem-

ical torture. Of this some idea may be formed from the following list of immediate principles obtained from it, as given by Pelletier.

Morphine, a base discovered by Serturner.
Meconic acid, discovered by Serturner.
Narcotine, a base discovered by Derosne.
Meconine, an indifferent substance? Dublanc and Couerbe.
Narceine, an indifferent substance? Pelletier.

Brown acid and extractive matter; a peculiar resin strongly electro negative; a fatty oil; caoutchouc gum; bassarine; lignine; and a volatile principle.—*Idem.*

8. *Nitrogen.* J. G.—One of the easiest methods of preparing nitrogen is to pass a current of chlorine gas through liquid ammonia. The ammonia is decomposed, muriatic acid formed, and nitrogen liberated which may be collected in a receiver. Mr. Emmett has recommended an equally easy and simple process for obtaining this gas. It consists in fusing nitrate of ammonia in a retort with some fragments of metallic zinc. This metal decomposes the nitric acid, and nitrogen and ammonia are given off. When collected over water the latter gas is absorbed. Mr. Emmett employs a small cylinder of zinc attached to a rod passing through the tubulure of a retort, by raising or depressing which into the fused nitrate he can regulate the emission of the gas.—*Idem.*

9. *Sulphurous Acid Gas.* Knezaurek has given a very useful and cheap method of preparing sulphurous acid gas. He introduces powdered charcoal into a retort and pours over it concentrated sulphuric acid, until on shaking it the mass appears moist. On heating, a constant stream of a mixture of two volumes of sulphurous acid and one of carbonic acid gas is given off, which continues till the mass becomes dry. This method may be used with great advantage in saturating alkalies or preparing the hypo-sulphites.

10. *Anhydrous sulphuric Acid.* J. G.—Prof. Mosander of Stockholm has communicated to me the following very simple mode of preparing anhydrous sulphuric acid. If oxide of antimony be treated with excess of sulphuric acid till the oxide is saturated, and the excess of acid then driven off by a low temperature the sulphate $\ddot{S}b + 3\ddot{S}$ is obtained dry and crystallized. If this dry salt be put into a retort and heated to dull redness, the greater part of the acid is driven off in an anhydrous state, and is easily condensed in a cool receiver.—*Idem.*

11. *On a substance called inflammable snow*; by M. Hermann, (Ann. de Pog. tome 28. p. 566.) J. G.—This substance fell from the sky on the 11th April, 1832, 13 werstes from the town of Wolokalamsk, and covered to the thickness of 1 to 2 inches a space of 8 to 10 square rultres.

It was of a wine yellow, transparent, soft, and smelling like rancid oil. Its sp. gr. was 1.1. It melted in a close vessel, and yielded the common products of vegetable substances, leaving a brilliant charcoal. It burnt with a blue flame, without smoke. It is insoluble in cold water, but melts in boiling water, and then swims on the fluid. Boiling alcohol dissolves it. It dissolves also in carbonate of soda, and the acids separate from the solution a yellow viscous substance, soluble in cold alcohol, and which contains a peculiar acid.

The analysis, by oxide of copper, gave

Carbon . . .	0·615
Hydrogen . . .	0·070
Oxygen . . .	0·315
	1·000

which corresponds to the formula 10CH+4OH. I gave it the name of d'ral élaïne, which signifies *sky oil.—Annales des Mines, Juin,* 1834.

12. *Stearine a compound body.* J. G.—Chemists have long since determined that animal fat contains two distinct substances, the one, *élaïne*, constantly fluid at common temperatures, the other *Stéarine*, as constantly solid.

M. Lecanu finds by experiment that Stéarine, especially that obtained from animal bodies, is formed of two distinct solid substances of unequal fusibility. To the least fusible solid he appropriates exclusively the name Stearine. It does not grease the fingers like tallow; it is hard like wax, inodorous, fusible at 62° Cent., slightly soluble in boiling alcohol, from which it separates by cold, largely soluble in warm ether, from which by cooling it separates in shining scales. Heated in the air it burns like fat bodies, but without the disagreeable odor of tallow.

When saponified, it is completely transformed into stearic acid and glycerine. This stearine may easily be extracted from tallow, by treating the latter with five or six times its weight of boiling ether, which completely dissolves it, and deposites the stearine on

cooling. It may also be obtained by solution in hot spirits of turpentine and subsequent cooling. This process will give, from mutton suet, more than a third of its weight of stearine, fusible at 60°. This is regarded as eminently adapted to bougies, superior to spermaceti and margaric acid, the former melting at 44° and the latter below 60°, while stearine fuses at 62°.—*Bull. D'Encouragement, Juin*, 1834.

13. J.G. *On the cementation of iron by means of carburetted hydrogen;* by M. Dufresnoy, Engineer in chief of the mines of France.—M. Macintosh, one of the best informed manufacturers of England, to whom the chemical machinery in the vicinity of Glasgow is indebted for numerous improvements, formed the idea of fabricating steel by exposing iron to a current of carburetted hydrogen. After various trials, the apparatus which he found the most convenient, consisted of a cast iron tube, lined internally with the refractory clay, used in the high furnaces of the Clyde. To prevent the shrinking which clay commonly undergoes, it is mixed with about one third of the same clay, baked, and reduced to fine powder. The tubes employed by M. Macintosh vary in length from four to six feet, and their interior width from ten to eleven inches. The coating of clay is two inches thick: it should be thoroughly beaten, and free from fissures. To accomplish this, a cylinder of wood is introduced, whose diameter is equal to that of the interior of the apparatus; the clay is put on in thin successive layers in the manner practised in the fabrication of glass-house pots. The tube has adjutages at each extremity. One of these serves for the admission of carburetted hydrogen, and the other for the emission of the gas. These openings may each be accurately closed so as to cause the gas to remain in the tube as long as convenient.

The tube is placed in a furnace so that it may be surrounded on all sides by coal.

Each tube is charged with 100 to 150 pounds of iron, the bars being placed lengthwise, and detached by small cross bars, in order that the gas may come into contact with the entire surface. After the fire is kindled, and the tube is sufficiently hot, a current of carburetted hydrogen is introduced, produced by the distillation of coal. But in order that the gas and iron may acquire the temperature requisite to the cementation, the hydrogen is renewed every half hour. During this time the gas is deprived in great part of its car-

bon, and as it issues from the tube burns with a flame which emits but little light.

The time necessary for the completion of the process depends on the dimensions of the bars of iron and the temperature to which they are subjected. When the tube is of a red brown color and the bars are two inches wide and six lines thick, eighteen or twenty hours are sufficient for the cementation. The iron may be very easily surcharged with carbon. I have seen thin bars which were almost in the state of graphite (plumbago). Trial bars placed in the discs which close the tube indicated the progress of the cementation and the moment when the operation should be stopped.

The steel, when taken from the tube, is covered with little blisters exactly like those made by the common methods. I have not seen the apparatus in operation and can give no details relative to the manner of conducting it; neither do I possess any statements of its economy. M. Macintosh, from whom I have the few details that have been mentioned, is satisfied that the process may with respect to expense, come into competition with the usual mode of cementation. He considers the steel obtained by the hydrogen gas as more homogeneous and of a superior quality to the ordinary. He has manufactured several tons in this mode in order to demonstrate the reality of his discovery for which he has obtained a patent.

All the steel fabricated by M. Macintosh has been sold and used, the greatest part converted into cast steel and employed in the manufacture of fine cutlery and the preparation of instruments which require steel of the first quality.—*Annales des mines*, tome v. 171.

14. J. G. *Determination of the Mathematical Law by which the elastic force of Aqueous Vapor increases with the temperature*; by M. Roche, Professor of Mathematics and Physics in the School of Marine Artillery, at Toulon. Extracted from the Recueil Industriel, for Mars, 1829.—It has been ascertained, 1st that a moderate increase of temperature, greatly increases the elastic force of steam; 2d that this force increases nearly in geometrical progression for every 30° of Fahrenheit,—the elastic force doubling successively for every successive augmentation of 30° from the boiling point.

The experiments however, both of French and English philosophers prove that the tension of steam at high temperatures varies very sensibly from this law, and various empirical formulæ have been

proposed, more or less exact, representing the law of elastic force: that of La Place, as stated in the Traité de Physique of Biot, has the form, $F = 760^m \times 10^{ai + bi^2 + ci^3 +}$, &c.
in which F designates the elastic force estimated in millimetres; 760 the height of the column of quicksilver supported by atmospheric pressure, and a, b, c, &c. constant coefficients which M. De la Place endeavored to determine by experiment: he found $a = 0.154547$, $b = -0.00625826$, &c. Such a formula is obviously rather complicated, and to apply it to high temperatures, the terms i^3, i^4, &c. would be requisite; i representing the excess of the temperature over 212°. But a more simple one may be found, by observing that the elastic force of the vapor increases for each element of the temperature, by a quantity which is in the compound ratio of the existing elastic force, and the increments of what I call the *expansive heat*, (chaleur expansive) and which is proportional to the product of the temperature by the density which it would give to steam, or to the quotient of that temperature by the volume which it tends to give to steam agreeably to the law of dilatation laid down by Gay Lussac. Thus, then the true law will be, that *the elastic force increases in geometrical progression, while the expansive heat increases in arithemetical progression*, and as this expansive heat, designating by x the excess of temperature above 100 centigrade would be proportional to $\frac{100+x}{8+0.03(100+x)}$ or $\frac{100+x}{11+0.03x}$, ($0.\frac{03}{8}$ being the coefficient of the dilatation or increase of volume for each degree): and as $\frac{100+x}{11+0.03x} = \frac{100}{11} + \frac{\frac{8}{11}x}{11+0.03x}$ we may regard the increments as proportional to the quotient $\frac{x}{11+0.03x}$ and express the elastic force by the formula,

$$F = 760^m \times 10^{\frac{nx}{11+0.03x}},$$

n being a constant coefficient, and 760^m the atmospheric pressure. This formula in taking the logarithms, becomes

$$\log. F = \log. 760 + \frac{nx}{11+0.03x},$$

if F be known by experiment, we shall find n in resolving the preceding equation in n, which will give,

$$n = \frac{11+0.03x}{x} (\log. F - \log. 760^m).$$

Now if we calculate the values of n which I call *the logarithmic module of the elastic force of steam*, by the table of elastic forces prepared by the Institute and published in the physique of M. Pouillet, we shall find a mean value of n which will be $n=0.17$, the other values differing very little from this, the formula becomes

$$\log. F = \log. 760^m + \frac{0.17x}{11+0.03x}.$$

In a memoir which I presented to the Institute in the month of February, 1828, and referred to the committee on the measurement of high temperatures in steam engines, I have shewn how the modulus of the vapors of other fluids may be found and their density calculated, and I found that the maximum of the elastic force of water takes place at a temperature of about 770°, at which its density is found to be nearly equal to that of the fluid in contact, the pressure rising to more than 4000 atmospheres.

15. *New Scientific Journals in Great Britain.* Ed.—We have received the first number of a spirited and able Journal published January 1st, 1835, at Bristol, England, by Geo. T. Clark, entitled the West of England Journal of Science and Literature—to be continued quarterly.

This work contains important original papers by able men, and various miscellaneous information. It will, we doubt not, prove an important auxiliary to the journals of London and Edinburgh, and will infuse vigor into that part of the kingdom.

A new Journal appeared at the above date in London, entitled Records of General Science, by Robert D. Thomson, M. D. with the assistance of Thomas Thomson, M. D. Regius Professor of Chemistry in the University of Glasgow. We cannot doubt that in such hands this new journal must prove a valuable acquisition to science. The present number contains an important paper by Prof. Thomas Thomson, on calico printing, and the selections from foreign journals are copious and various.

16. *Report on the fresh water Limestone of Burdie House, near Edinburgh, by Dr. S. Hibbert.*—We have received from the author his valuable memoir of 114 pp. quarto, with numerous plates. The existence of fossil Saurian fishes, some of them of enormous size, beneath the coal formation, is now fully established; and Dr. Hibbert has described and elucidated the interesting facts, respecting

these and many other organic remains whose real character—especially as regards the Saurian or Lizard fish was established by the personal examination of Prof. Agassiz at the great scientific meeting at Edinburgh, Sept. 8th, 1835.

Appended to Dr. Hibbert's memoir is another by Arthur Connel, Esq. on the analysis of coprolites and other organic remains in the limestone of Burdie House.

The coprolites consist principally of phosphate of lime with a little fluoride of calcium 83 to 85 parts in 100, carbonate of lime 10.78 to 15.11, and small portions of bituminous matters, alkalies and silica.

17. *Refraction and polarization of heat.* Ed.—From the author, Prof. James D. Forbes of the Univ. of Edinburgh, we have received a very curious and important memoir on the subject named above. It was read before the Royal Society of Edinburgh, Jan. 5th and 9th, 1835. We have only room to state the conclusions of the learned author.

1. Heat, whether luminous or obscure, is capable of polarization by tourmaline.

2. It may be polarized by refraction and reflection.

3. It may be depolarized by doubly refracting crystals. Hence,

4. It is capable of double refraction, and the two rays are polarized. When suitably modified, these rays are capable of interfering like those of light.

5. The characteristic law of depolarization in the case of light, holds in that of heat, viz. that the intensities in rectangular positions of the analyzing plate are complementary to one another.

6. As a necessary consequence of the above, confirmed by experiment, heat is susceptible of circular and elliptical polarization.

7. The undulations of obscure heat are probably longer than those of light. A method is pointed out for deducing their length numerically.

18. *Mémoires Geologiques et Paleontologiques*, published by A. Boué. Ed.—This is the first number of a Geological Journal which is to appear occasionally.

The present number contains 362 pages and is illustrated by plates. In common with the Bulletin of the Geological Society of France, it proves the great and increasing interest in this science which is felt in that country.

The name of Boué is a sufficient guaranty that the work will be conducted with ability.

19. *L'Institut, Journal Général des sociétés et travaux scientifiques de la France et de L'Etrangere.*—Nos. 95 to 102 except 98. This is a scientific news bulletin and must prove very useful.

20. *Adhesive power of the cement of the Castle Rock.*

Quebec, March, 1835.

To. Prof. SILLIMAN, *Sir*—To determine its comparative adhesive powers, three pairs of fire bricks having iron rings rivetted into them to allow of the suspension of weights, were cemented together two and two on the 19th November last with three varieties of cement, each cement being mixed with ⅓ sand and ⅓ dry lime. These bricks were placed from the period they were set until the 24th Feb. 1835, in a cold room where the temperature was often many degrees below the freezing point, after which they took the following weights to separate them, viz.

Place of manufacture.	Separating weights.
Hull on the Ottawa, U. C.	4 cwt.
Harwich, England,	6 "
Quebec, - -	10 "

In this experiment the hook of the balance broke with 9½ cwt. and the bricks falling among the weights were taken up and afterwards bore the 10 cwt.

While on the subject of cement, I may observe that in the perusal of the "chemical and external characters of the *lower* strata at the Trenton Falls given at page 186 of vol. I. part 1 of the Lyceum of Natural History of New York," I was struck with its *apparent* agreement as regards *constituents* with our black rock, and was also in consequence induced to ask if it be a hydraulic limestone?

The geological characters of the two rocks are certainly very different not only as regards the inclination of the strata which is here great, but also with respect to the occurrence of fossils in them, these as you well know affording none if we except small seams of anthracite, certain anthracitic investments and a bituminous gum or oil. And the fact of the great profusion of organic remains "contained in every part of the rocks," as stated by Prof. Renwick, leads me to the opinion, notwithstanding the presence of the Calymene Blumenbachii, that the formation at Trenton Falls is the Carboniferous limestone of Phillips or upper transition limestone of

most continental writers; it must be admitted, however, that the purity, light grey color, and crystalline structure of the upper portion of the rock is against this supposition. F. H. Baddeley.

21. *Transactions of the Literary and Historical Society of Quebec*, Vol. iii. part iii.—The contents of this publication are, Medical Statistics of Lower Canada, by Dr. Shelly; Canadian song birds, Mrs. Shepard; Inscription in the heart of a growing tree, Mr. Shepard; Analysis of a mineral water from Gaspé, Ancient document relating to Acadia, Island of St. Paul, Mr. Adams; Temperature of the springs at Quebec, Mr. Shelly; Travertine or calcareous Tufa, H. D. Sewall, Esq.; Canadian Etymologies, Andrew Stuart, Esq.; Geol. Sketch of the most N. E. portion of Canada, Lt. F. H. Baddeley, R. E.; Meteorological Journal on Lake Superior, 1824; Meteorological Journal on Cape Diamond, Quebec, Jan. 1832 to Dec. 1834.

This spirited society has contributed many important communications of general and local interest, and we are happy to observe by its annual report that its library and various collections in natural history, &c. are increasing; its library contains between 500 and 600 volumes, and its museum about 600 specimens, arranged and described. This society, with the sister institutions in Montreal and York, will do much for Canada, and we trust will meet with co-operation, and kind as well as valuable encouragement from similar institutions, and from liberal individuals in the United States.

We learn that the British authorities in Canada are prosecuting their topographical and geological surveys: able reports have been already presented by Dr. Bigsby, Capt. Bonnycastle, Capt. Bayfield and Lieut. Baddeley, and we are informed that the latter gentleman will soon proceed to make observations between lakes Huron and Nipissing.

22. *Journal of the Geological Society of Dublin*, Vol. I. part i. and ii., 1833–4.—The institution of a Geological Society at Dublin, Ireland, in 1833, has already given birth to two numbers of their Journal, extending to 139 pages, and illustrated by maps and plates. The subjects are,

Part I. The president's addresses; The theory of Geological phenomena in Ireland, by Capt. Portlock; Globular Formations, Prof. Stokes, Univ. Dublin; Fossil deer of Ireland, Dr. J. Hart;

Trap of Limerick, Prof. Apjohn, M. D.; Diluvial action in the north of Ireland, James Bryce, Esq., M. D.; Geology of Erin, county of Mayo, P. Knight, Civil Engineer.

Part II. Geology of the vicinity of Alten Mines, Finmark, by John Petherick, Esq.; Vein of Granite in Mica Schist, Wicklow, R. J. Graves, M. D.; Basaltic District of the North of Ireland, Capt. Portlock; Indentification of Strata, the same; Granite south of Dublin, Rev. H. Lloyd; Geology of the Knockmahon Mines, Waterford, J. H. Holdsworth; Landslip in Antrim, Js. McAdam, Esq.; Cave between Caher and Mitchelstown, Js. Apjohn, M. D.; Trap of Limerick, W. Ainsworth, Esq.; Geology of Frannet, in Donegal Co., Js. McAdam, Esq.

In these papers there is much valuable local information, connected more or less with general scientific principles; and we may anticipate still more extended researches.

23. *Belfast Natural History Society.*—It appears from the minutes of the proceedings of the Society, (June, 1834,) that it is in a course of successful exertion. It has a fine building, a moderate revenue, without debt; a museum and library already very considerable, and a sure fund in the zeal and activity of its members.

24. *Ichthyosaurus, fossil fish, wood, &c.*—Extract of a letter to the Editor from England, dated May 12, 1835.—"Miss Mary Anning, the female geologist is reported to have discovered the largest Ichthyosaurus ever found. This gigantic animal must have died and its bones fallen abroad at the decomposition of the body, just before they were covered with the lias. The bones lie in the marl as is usual. This animal I understand, must have been at least thirty five feet in length and of considerable breadth: the one I possess must have been twenty eight feet.

The collection in the British Museum, is now very fine. We have just completed our museum in Newcastle upon Tyne, which, in the Fossil Flora, much exceeds any in the kingdom. Mons Agassiz, lately selected from my museum thirteen varieties of *magnesian fossil fish (which he had never seen before) for his new and beautiful work. He is a most intelligent man.

Among the fossil woods which you were so good as to send me, the one from south of Lake Erie, was dicotylidonous.

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* From the formation of the magnesian limestone.

Coal-fields are opening out in this country and railways intersecting the country in all directions. Probably ere ten years are over the mail between London and Edinburgh, will be carried by rail way both on the east and west side of England."

25. *Law of Magnetic attraction and repulsion.*—Mr. R. W. Fox, concludes " that the *laws* of magnetic attraction and repulsion alter according to the distance of the magnets from each other, the force at small distances being in the simple inverse ratio of the distance and when further separated, in the inverse ratio of the square of the distance. This change of ratio in the case of attraction, gradually took place at the distance of from one eighth to one quarter of an inch, and even at half of an inch when larger magnets were used; and in the case of repulsion the change in the law occurred at much greater distances, especially when the forces of the respective magnets were materially different.

The influence of the terrestrial magnetism may probably extend to a vast distance from our globe; and if the magnetic forces be common to the planetary system, the *remarkable uniformity* in the places of the *nodes* of most of the planets in relation to the *plane of the solar equator* may perhaps be referred to their agency.—*Lon. and Edin. Phil. Mag. July*, 1834.

26. *Soap Stone.*—To the Editor.—*Dear Sir*—In a late extract from your Journal I observed a notice of the steatite or soapstone of Middlefield, Mass. together with a request that other notices of this class of minerals might be communicated.

I have observed this mineral in seven places in the Green Mountain range, and have supposed it to be an extensive formation stretching through no inconsiderable portion of this chain. In the town of Bethel in the north part of Windsor County I obtained specimens of this mineral, which are considerably harder than those of the old quarry in Middlefield and less unctuous to the touch. In the town of Grafton in the Northern part of Widham county there is a valuable bed of steatite, bearing a strong resemblance to that at Middlefield and remarkably free from foreign substances. It is extensively used in this region for aqueducts and is found to be a cheap and imperishable material for this use. From the gentleman who laid an aqueduct of this kind for our seminary and my own dwelling house, I learned that the stone is first sawed into blocks about three inches square, and from one to two or three feet in length and these

bored by an augur standing in a vertical position. Thus prepared the pipes are joined by lead tubes adapted to the bore and an inch and a half or two inches in length. The whole process, of preparing and laying the aqueduct is extremely simple and expeditious, and well illustrates one of the various and important uses to which this invaluable mineral may be applied.

Very respectfully yours, &c. L. Coleman.

Manchester, Vt. Febuary 20, 1835.

27. *Fibres of The Rose of Sharon.**—To Prof. Silliman.—*Dear Sir*,—A few days since while collecting together decayed vines, &c. in my garden for the purpose of covering a fennel bed for the winter, I cut a quantity of the decayed stalks of the Rose of Sharon, a perennial flower plant which is in most of our gardens, and so well known that a more particular description is at present unnecessary.

The bark on those stalks which appeared to be of the earliest growth, I observed was cleaving off; and all of them were so far decayed that the bark was easily stripped from them.

On examining the fibre which appears much like hemp when first detached from the stalk, I found it strong and capable of being divided into small fibres like those of flax. I preserved a small quantity of it, and without attempting any process to prepare it for use, twisted a few small cords which, together with a sample of the *raw material*, I have taken the liberty of sending to you for a more critical examination, as well as for the inspection of others to whom you may think proper to show them, should you think the subject deserving your and their attention.—I would not presume to pronounce hastily upon the utility or value of this discovery, if such it may be denominated: but I am prepared to say if the fibres contain sufficient strength for cordage or canvass, I can discern no reason why it may not be a good substitute for flax and hemp.

If, upon trial of the sample sent, it should be thought deficient in strength, I would remark that it has been subjected to no macerating process, but has stood exposed to the vicissitudes of the weather till a natural and gradual decay of its strength may have taken place.

How the cords I send will compare in point of strength with those of the same size made of hemp or flax, I have had no opportunity for deciding—I am of the opinion, however, that this will not be found

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* The Hibiscus palustris, or the H. Syriacus.

objectionable to any considerable degree if at all. You will percieve that the coat of this plant is much thicker as well as softer and more silky than that of hemp. Whether the fibres be sufficiently fine for fabrics of the finest texture, remains to be ascertained, but I am confident it will prove itself to be at least a valuable material for the manufacture of paper.

The plant is of a robust and healthy character, and is easily grown in all the good soil of our country. It is also highly productive in seed, and being a perennial, might be raised with great facility in a long succession of crops on the same ground, and, as I should believe, with less labor and a greater product than either hemp or flax.

If my present views of the properties of this plant are not visionary, I cannot but indulge a hope that the culture of it may be made useful to our country.

Yours very respectfully. SAMUEL WOODRUFF.

Remark by the Editor.—This vegetable material, judging from the specimens sent, appears to deserve all the commendation bestowed upon it above.

28. *A Sea Serpent.*—The following statement having been made by a gentleman of great intelligence and candor, a cool and judicious observer, who has travelled very extensively and traversed the seas in many climates, the editor desired a written notice of the facts which he is permitted to publish without the name of the author; with him he is however well acquainted and reposes full confidence in his integrity and in his freedom from any influence of imagination.

Boston, April 5th, 1835.

To PROF. SILLIMAN,—*Dear Sir*,—On my passage from the River La Plata to this country in January, 1824, latitude 34½° South, and 48° West longitude, I saw what was first supposed to be a fish called an Albicore; but, on further examination it was discovered to be a serpent of which I cannot give a clearer description than to say that a common dark colored land snake is, in miniature, a perfect representation. A light breeze prevailed at the time and the sea was quite smooth. It first appeared within ten feet of the vessel, its head was, perhaps, two feet above the water and appeared as large as a ten gallon keg; the eye was distinctly seen. The whole length of the serpent was about half the length of the vessel, say 40 feet. The size and circumference of the body, was nearly as large as a barrel; nothing like a fin was seen. I could not make out the distinct ap-

pearance of the tail. The serpent remained almost motionless while in sight, the head above water and eyes directed towards the vessel.

Remark by the Editor.—The distance of the place of observation being several hundred miles from the nearest coast, this serpent must have been a denizen of the ocean; for the huge land snake of South America could not navigate so far out to sea if indeed they ever take to the ocean at all. The snake was perfectly quiet, and appeared quite comfortable and at home on the waves. We must therefore consider this case as settling the question of the real existence of a Sea Serpent. The absence of paddles or arms forbids us from supposing that this was a swimming saurian.

"*The Sea Serpent.*—Captain Shibbles, of the brig Manhegan, of Thomastown, from Boston, for New Orleans, which arrived here* on Saturday last, states that he saw when about nine or ten miles from Race Point light, what he, as well as the whole crew supposed to be a Sea Serpent,—he could distinctly see it with the naked eye, but to be certain, he took his glass and saw his eyes, neck and head, which was about as large as a barrel—the neck had something that looked like a mane upon the top of it;—several times he raised his head seven or eight feet above the water, and for thirty or forty minutes he swam backward and forward with great swiftness. There were two other vessels near, the crews of which were in the rigging looking at the same object. Capt. S. states that it was very long, and that his head, neck and tail and his motion in the water, was exactly like those of a snake; every time he put his head out of water, he made a noise similar to that of steam escaping from the boiler of a steam-boat. One of the crew told us that his appearance and motion was precisely like that he saw last summer while in the bay, which was said to be a Sea Serpent. The Captain and crew attest to the correctness of this statement."

29. *New publications.* Ed.—*Journal of Natural History*, by the Boston Natural History Society, Part I, No. II. This number contains articles—

On certain causes of geological change now in operation in Massachusetts, by Prof. Edward Hitchcock.

Enumeration of plants growing spontaneously around Wilmington, N. C., &c. by Moses A. Curtiss, A. M.

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* Gloucester, (Mass.) March or April, 1835.

Upon the economy of some American species of Hispa, by T. W. Harris, M. D.

Descriptions of new North American Coleopterous insects, &c. by Thomas Say.

Description of a new animal belonging to the Arachnides of Latreille, from the sea on the shores of the New South Shetlands, by James Eights, M. D.

Chemical analysis of Chrysocolla, from the Holquin copper mines, near Gibara, Cuba, by Charles T. Jackson, M. D.

This journal does credit to the spirited and promising institution from whose labors it emanates. Their museum is in excellent order, arranged with science, taste and judgment, and is already extensive for the time it has been forming; it is an ornament to Boston, and will become a standard institution for the Eastern States; it follows with no tardy steps in the course of the Academy of Philadelphia and the Lyceum of New York.

30. *Eulogium on Simeon Dewitt, delivered before the Albany Institute, April 23d*, 1835, by Dr. T. Romeyn Beck.

This is an affectionate tribute to the memory of a great and good man—a companion in arms and friend of Washington—a patriot and philanthropist—a man of science and a christian—whose honored life was extended to almost fourscore, and covered almost half that of the period of the existence of his country.

31. *Treatise on Mineralogy, consisting of descriptions of the species, with five hundred wood cuts.* By C. U. Shepard, Lecturer on Natural History in Yale College, Corresponding member of the Academy of Natural Sciences of Philadelphia, of the Geological Society of France, &c. &c. In 2 vols. 12mo. pp. 675. New Haven, Hezekiah Howe & Co.

The Treatise here announced is the completion of the work, the first part of which was published in 1832, and of which an account was given in Vol. xxii, p. 395 of this Journal. Its plan and scope will be best judged by a few extracts from the author's preface.

"The eclectic character of my introductory volume, which was intended to give a view of all the departments of mineralogy excepting Physiography, rendered it difficult for persons employing it to avail themselves of other treatises for full descriptions of the species. The inapplicability was principally owing to my adoption of

the improvemts of Mohs in relation to simple and compound varieties and to the numerical scale for expressing the hardness, and to my following Brooke in the treatment of the regular forms; not to mention the circumstance that my artificial tables enumerated a number of species whose descriptions had not found their way into any English work. This was foreseen in the preparation of that volume; and notice was accordingly given in it, that a second part, devoted exclusively to descriptions, and constructed in accordance with the principles of the first, was in preparation.

"In addition to the desire of supplying what was thus wanting to carry out the plan of study which had appeared to me to possess the greatest advantages, I was stimulated to the attempt, in the hope of being able to contribute something towards the more satisfactory determination of American localities; an undertaking for which my mineralogical travels had afforded me considerable facilities. Indeed, so numerous had been the discoveries in important mineral depositories since the last edition of Cleaveland's Mineralogy, and the publication of Robinson's Catalogue, and so many doubtful points existed in relation to many of those quoted in these works—not a few having been erroneously announced, either through inaccurate determinations of the species, or their occurrence in trifling and accidental quantity—that the proposed work seemed justifiable solely on this ground, provided there was a reasonable hope of placing the subject in a more just light. Besides, it was had in view to indicate the crystalline forms noticeable among our minerals, a point which had been so much overlooked as to have created a very unfavorable impression of the mineralogical riches of the country. There seemed room also, to perform a desirable service by appropriating to the work, the latest discoveries of the German mineralogists, to whom the science is indebted for its most important advances during the last ten years.

"The alphabetical arrangement of the species has been adopted because it seemed most likely to subserve the convenience of students using my characteristic, or any other, in the determination of specimens; as well as that of persons having occasion to refer to the descriptions for less general purposes, as for example, to learn only the crystalline form of a particular species, or to obtain information respecting its locality. Had the natural-historical arrangement, the chemical, or any mixture of the two, been employed, the inconveniences of consulting an index must necessarily have been encountered.

"But while the alphabetical distribution has the advantage at least, of being independent of all scientific arrangement—concerning whose present existence many entertain doubts—the two tabular views, one at the commencement of this volume, and the other at the conclusion of the second, will present the species grouped in accordance with two classes of affinities, the first, the natural-historical, the second, the chemical, resemblance. In the construction of these tables, I cannot, of course, suppose that I have acquitted myself to the satisfaction of all, when I have but so imperfectly satisfied myself.

"The chemical arrangement, however, is such as the present state of chemical science seemed to force upon me without much choice. A more extensive and accurate analysis of minerals, however, will undoubtedly produce in it many changes, while also it it will permit the composition of a considerable number of species, now left in uncertainty, to be expressed with atomic precision. * *

"The natural-historical arrangment of the species is principally that brought forward by Mohs. I have nevertheless ventured, though not without considerable hesitation, to propose a number of alterations, which will be obvious on a comparison of the two systems. In making these changes, I have endeavored so to constitute the genera that the species of each should be bound together by a similar amount of resemblance. If in the execution of this difficult task, I have not violated the affinities of the species, an important advantage will have been secured, in the simplification of the nomenclature, by the great reduction of genera, especially in the orders, *Ore*, *Pyrites*, *Glance*, and *Blende*.

"The formation of the new order, *Picrosmine*, appeared to be indispensable in providing a place for a number of species, which Mohs had declined incorporating with his system from their deficiency in regular forms. The production of *Lusine-Ore* was rendered necessary for a similar reason, in order to receive such species of the requisite structure and specific gravity, as are believed to owe their formation to the decomposition of other species. The above mentioned writer does not allow such minerals, provided they are in a friable state, to constitute distinct species; remarking of them, that "it is in direct opposition to the principles of Natural History, to consider decomposed varieties of one species as varieties of another." To the correctness of this as a general rule, I readily assent, allowing it full force when the resulting mass is not homogeneous in its mechanical composition and at the same time destitute of a fixed chemical constitution."

Mr. Shepard's work is very valuable. His knowledge of minerals is familiar and accurate; he has visited many of the most important American localities, and he has exceeded all others in obtaining rare, beautiful, and instructive American specimens; his acquiantance with crystallography is exact, and he examines, measures, figures, and describes crystals with great tact; his work abounds in good figures, inserted *upon the page*; he gives the information that is desirable respecting American minerals; his style is condensed and perspicuous, and by adopting the form of a dictionary he avoids the difficult question of arrangement, and affords the pupil great facility. We are gratified that he has generally adopted proper names, and that he has only *added*, and not *prefixed*, the strange nomenclature of Vienna.

We regret, however, that he has not given the etymologies of names, since a powerful aid is thus brought to the memory, and we think that he should have been more free in naming synonymes, discoveries and discoverers. We regret that he thought it better to prefer the complex group of primary forms of crystals now in use, to the simple and lucid system of Haüy, and we cannot think that any attempt to indicate hardness by numbers can be very successful with an inexperienced pupil. Kirwan attempted it long ago with little utility. In our opinion, hardness is better indicated by a direct comparison with known and familiar objects; for the novice cannot readily bring to mind a considerable list of minerals to which the numbers refer and then connect the number with both the mineral and with the degree of the quality: the experienced mineralogist can indeed do it, but the work is intended mainly for the tyro. We are gratified to observe that full notices are given of the results of the chemical analysis of minerals, without which we can feel little satisfaction in a mere picture of external and physical properties however perfect; both together make the portrait complete.

Since Mr. Shepard's volumes have appeared, we are put in possession of magnificent crystals of fluor spar from Musconongie lake,* sent by Dr. Crawe of Watertown, N. Y. Some of them are green, and one mass of that kind in our possession weighed one hundred pounds. There can be no doubt that Mr. Shepard's work must have a general currency and become the standard book in this country,

* One of a group of small lakes in Jefferson County, N. Y. not very remote from Lake Ontario and the St. Lawrence River.

and we trust it will not be unknown or unappreciated in Europe. While we shall always cherish with gratitude our early instructors, Jameson, Brongniart, Phillips, Haüy, Brochant and Cleaveland, we are much gratified, as all these books are now out of print, that we can substitute so learned, so exact, so complete and so lucid a work as that of Mr. Shepard.

32. *New work by Prof. Brown of Heidelberg—Sharks teeth—Conrad on shells, &c.*

Extract of a letter from Lt. W. W. Mather, dated West Point, June 11th, 1835.

To the Editor—*Dear Sir*—Prof. Brown desires that you would notice in the Journal, a work of his now publishing, entitled Lethæa Geognostica, or descriptions and figures of the characteristic fossils of the different geological formations of both continents. The two first numbers have been forwarded to me, but have not yet arrived. A work of this kind is a desideratum with every practical geologist.

Prof. Brown says that the fossil teeth from the marl pits of New Jersey of the following forms,
are the Squalus raphiodon of Agassiz,
" " pristodontes " "

and both belong to the chalk formation; thus offering an addition to the mass of evidence in support of Dr. Morton's views of the geological character of the New Jersey marls. Mr. Conrad's work on fossil shells is more appreciated in Europe than in this country, and it is to be hoped that he will persevere through all difficulties and continue it. It is very highly spoken of in some of the foreign periodicals.

Prof. Brown in his letter remarks, " Il serait fort dommage, si le travail de M. Conrad ne seroit pas continué, parceque cest seulement par de semblables entreprises, que nous parviendrai a comparer parfaitement les Faunes et Flores fossiles des deux continents. Je me suis fait un devoir, de l'analyzer, et de le recommender dans notre Journal de Geologie."

33. *A comprehensive system of Modern Geography and History, revised and enlarged from the London edition of Pinnock's modern*

Geography, and adapted to the use of Academies and Schools in the United States. By EDWIN WILLIAMS. New York, *Bliss & Wadsworth.*

This is an excellent book, and not inferior in value to any which have been put forth by this most industrious compiler and author. The work is of that terse comprehensive character, which distinguishes his former productions. It is full of entertainment and instruction, clear and judicious in style and arrangement, discriminating in the selection of topics, abundant in details, and conducted with that peculiar brevity which leaves not a word redundant or deficient.

It is a valuable class book, and merits general adoption in the schools.

34. *Geological Report on the elevated country between Missouri and Red River, from an examination in* 1834, by G. W. FEATHERSTONHAUGH, Esq., pp. 97, *Gales & Seaton.*

This report is accompanied by a colored section presenting the geological formation between the coast of New Jersey on tbe Atlantic and the Red river on the confines of Mexico a distance of 1600 miles. It is introduced by a sketch of scientific geology as it stands at present, upon the basis of very extended observation in both hemispheres, conducted by a great number of able men possessing collectively of all requisite science. This sketch is followed by geological, topographical and other notices of the extensive region over which the author travelled and which abounds with interesting and important facts. This report is a document which geologists, both at home and abroad, will consult with advantage, on account of the wide range which it covers, the splendid features of the country and the scientific precision and perspicuity with which it is described.

35. *Report on the new map of Maryland*, 1834.—By accident this important report, failed to come under our observation until recently. It is illustrated by two maps relating chiefly to the tertiary region, and by a tabular statement of the results of the analysis of marls.

By agreement with the general government, the triangulation under Mr. Hassler has been made available towards the survey of the coast of Maryland, and thus greater utility is given to both undertakings.

The geological part of this report while it has a correct scientific bearing, presents the application of marls to agriculture as a leading

topic. This arises from the fact that there are immense treasures of shells—the riches of exuberant tertiary deposits which being partially decomposed or readily susceptible of that process, are happily adapted to fertilize the soil.

We have no doubt that the united labors of Messrs. Alexander and Ducatel, will bring this arduous survey to a happy conclusion, alike useful and honorable to the state and the country.

36. *Asclepias Syriaca.*—Memorandum of specimen articles manufactured *exclusively* from the long fibre of the external and internal cortex of the asclepias syriaca, namely, asclepias thread, netting bags and purses, tapes, socks, knotting for fringes and daisy trimmings, fancy fibrous and flossy flowers, flossy feathers in imitation of the ostrich, papers, hats in miniature.

We have seen at Salem, in the hands of Miss Gerrish, articles corresponding with the above list and manufactured from the asclepias by her own hand. They are very beautiful and command the admiration of all who see them.

We are fully satisfied that the ligneous fibre of this plant, (we do not refer to the fine glossy down which bursts from the ripe pod and floats away in the wind) is capable of being wrought into many forms both of utility and ornament.

The plant is hardy and is raised with the greatest facility.

37. *Strontian in Marcellus, Onondago Co., New York.*—Extract from Eaton's Geological Text-book; second edition, published in June, 1832, page 109. "Carbonate of strontia and lime, (very vaguely described by foreigners under the name Arragonite) has been found to be an excellent flux—its excellence increases in the ratio of the proportion of strontia. In crystals it is found in small quantities in the geodiferous limerock of Lockport, Niagara falls, &c.

But it has not hitherto been announced in any printed publication, which has come to my knowledge, in sufficient quantities to be used profitably by artists as a flux. A few days since, a Mr. William Deere of Syracuse, (formerly my pupil, now a Teacher) brought me twenty pounds of this mineral from Marcellus, Onondago County, midway between Onondago and Skeneatelas, and five or six miles south of a point on the Erie canal, seventy five miles west of Utica. It is in connexion with Corniferous lime-rock, probably beneath it, and equivalent to geodiferous lime-rock. Some specimens seem to

contain a larger proportion of strontia, than any analyses of aragonite have heretofore shewn. Its specific gravity ranges between 2.75 and 3.8. I have merely tested it by the purple flame; but I intend to make a thorough analysis soon, unless some one, who has more leisure, will do it. It appears that tons of it may be had. Pillars three inches in diameter, for a clock have been made with it, which may be seen at Syracuse." It takes a most beautiful polish.

38. *Schoharie Minerals.*—Mr. JOHN S. BONNY of Schoharie, (N. Y.) desires the following statement to be made in addition to what has already been published on this subject in Vol. xx, p. 172 of this Journal.

"No. 1 and 2, (see article above named). The acicular variety of Strontianite, were both discovered by me.

"No. 3 and 4. Heavy Spar, were both discovered by J. Gebhard, Jr.

"No. 5 and 6. Two other varieties of Strontianite were discovered by Mr. Gebhard, Sen. and myself in company.

"No. 7. (The marble quarry) massive Strontianite was discovered by myself and son."

Where several persons are contemporaneously engaged in searching after the same minerals, it is not remarkable that a difference of opinion should arise as to the question, who picked up the first specimens. Whatever discrepancy therefore exists in the present case, does not in our view, involve any other than honorable intentions in the parties concerned; all of whom merit and doubtless have received, the thanks of mineralogists, for these very zealous labors.

39. *Geological Survey of Connecticut.*—The Legislature of this state at their last session passed a resolve authorising the Governor to cause a geological survey of the state to be made, and a report thereon to be presented at their next meeting. Governor Edwards, has accordingly appointed DR. JAMES G. PERCIVAL, and MR. CHARLES U. SHEPARD, to this duty. These gentlemen have already entered upon their work, and propose to devote the remainder of the season to geological travels and researches with a view to the preparation of a report pursuant to the resolution.

We have no doubt, that Dr. Percival and Mr. Shepard, will execute this work with faithfulness, zeal and ability, but the period as-

signed is too short; for a geological survey, must be the result of careful and discriminating observation and must involve both multiplied details, and enlarged views founded on science. The project of a geological survey of Connecticut, was brought forward before the Connecticut Academy of Arts and Sciences, more than twenty five years ago, by Prof. Silliman, and adopted. A report was then made by him to that body of the mineralogy and geology of the vicinity of New Haven, which was published in the Transactions of the Academy, and was we believe, the earliest example of the kind in this country. No funds being provided for prosecuting the undertaking it necessarily slumbered.

The discovery of the verd-antique marble and serpentine near New Haven,—a mineralogical and geological tour in the counties of New Haven and Litchfield, (This Jour. Vol. II, pa. 201,) the account of the Trap rocks near Hartford, (Id. Vol. XVII, pa. 119,) the report of Prof. Mather, on the Geology of the Eastern and North Eastern part of Connecticut, (Id. Vol. XXI, pa. 94,) and the report of Mr. Alfred Smith, on the geology of the valley of the Connecticut, (Id. Vol. XXII, pa. 1,) besides many less important notices, prove that the subject has not been forgotten.

We are however, much gratified to see the project revived by Gov. Edwards, and that a similar movement is taking place in other states, in accordance with the spirited effort in Massachusetts, by Prof. Hitchcock.

The time, we trust, is coming, when all our vast territory will have been surveyed, geologically, topographically and trigonometrically, and when some master-spirit will digest, arrange and elucidate all the immense store of facts and refer them to their proper uses both in science and the arts.

The object is well worthy of the expenditure of millions.

40. *Uranite at Chesterfield, Mass.*—Mr. Shepard, has lately found this mineral in the Tourmaline vein disseminated through the laminæ of Albite. It is in crystalline plates and pulverulent; and is uniformly of an emerald green color. The variety from Middletown, quoted in Shepard's Mineralogy, is of a pale siskin green color.

41. *Question by B. Thornton, L. S., New York.*—Given any two lines as AB, BC, change one of those lines, and represent two mean proportionals between the said changed line and the other;

and let one of the mean proportionals more one of the lines, be squared, and the square of said proportional subtracted therefrom, the residue is to equal the square of one of the first given lines geometrically.

42. *Chromate of iron* was discovered by the late Gen. Martin Field, in Townsend, Vt.—*Letter to the Editor from Dr. Jacob Porter dated Plainfield, Mass. March* 14*th*, 1835.

Extracted by O. P. Hubbard.

CHEMISTRY.

1. *Phloridzin, a new substance.*—Messrs. Koninck & Stay announce their discovery of a new organic substance in the bark of the crab-tree, the wild pear, plum and cherry trees, which they name *Phloridzin*, and of which they will soon publish a complete account. —*L'Institute, Mars*, 1835.

2. *Preparation and analysis of some essential oils*, by M. R. Blanchet.—*Oil of Roses.* 0.508 parts of a sample of oil of roses, which presented all the properties of the true essence of Persia, having been burned with oxide of copper, gave 1.380 of carbonic acid, and 0.555 of water, or in 100 parts, 75.11 carbon, 12.13 hydrogen, and 12.76 oxygen, a result very remarkably different from those obtained by Saussure and Gœbel. Alcohol separates this oil into portions very nearly equal, of stearoptine and eleoptine.—*Stearoptine of Oil of Roses.* The process by which this is prepared, is founded upon its different solubility in alcohol and ether. Mix oil of roses with 3 parts of alcohol at 33° B., and dissolve in ether the stearoptine which is deposited, and remove by repeated washings the eleoptine which still adheres to it. At a temperature of + 25° C. it presents the appearance of crystallization like butter; is melted at +35° C., and boils without alteration between 280° and 300° C., giving out the odor of boiling fat oil. At a very elevated temperature it burns like olefiant gas with a clear flame and no soot. 0.338 of this substance burned with the oxide of copper produced 1.005 carbonic acid and 0.438 water. It consists therefore of

	By experiment.	By calculation.	Atoms.
Carbon	85.86	85.98	1
Hydrogen	14.46	14.02	2

which accords with the analyses of Saussure, and also with the constitution of olefiant gas and paraffine.—*Oil of balsam copaiba.* This oil, extracted from a specimen of balsam copaiba, entirely transparent by aqueous distillation, then rectified and dried by chloride of calcium, and entirely colorless, had no action upon litmus paper, at 22° C. had a density of 0.8784, boiled at 245°, and dissolved at 25°, in 30 parts of alcohol 33° B., in 2.5 of absolute alcohol, in every proportion in absolute ether, and hardly any in 0.5 of the ether of commerce; it was not decomposed under the influence of nitric acid sp. gr. 1.32, but with the aid of heat gives rise to a body of a resinous appearance, is colored red by sulphuric acid, and under the influence of solar light unites with chlorine with the disengagement of a great quantity of heat, and forms a crystalline body which is deposited on the sides of the base, and passes from yellow to blue, and then to green. 0.560 of this oil analyzed by oxide of copper, gave 1.777 carbonic acid and 0.588 water; in a second experiment 0.482 produced 1.543 carbonic acid and 0.510 water. Its composition is therefore

	By experiment.	By calculation.	Atoms.
Carbon	87.74 : 88.51	88.46	5
Hydrogen	11.66 : 11.75	11.54	8

which accords with the analysis of oil of turpentine and oil of citron.—*Hydrochlorate of oil of copaiba.* This results from the union of hydrochloric acid gas with the oil which the balsam copaiba distilled alone furnishes, and which has been carefully rectified and deprived of water by chloride of calcium. It is purified by pressing it between sheets of blotting paper, dissolving in ether, and precipitating it by alcohol, and washing. It consists of

	By experiment.	By calculation.	Atoms.
Carbon	57.95	57.94	5
Hydrogen	8.73	8.50	9
Chlorine	33.04	33.55	1

a composition similar to that of hydrochlorate of oil of citron, from which it differs only by its boiling point, by not being sublimed, and by its reaction upon sulphuric acid.—*Oil of cajeput.* The oil analyzed was brought from India by a scientific gentleman; was very fluid, of a clear green and transparent, its aroma penetrating, analogous to that of camphor, taste hot, specific gravity 0.9274 at 25° C., boiling point 175° C., soluble in iodine without any action.

1. 0.536 rectified oil gave 1.510 carbonic acid, and 0.559 water.
2. 0.6225 " " " 1.758 " " " 0.638 "

Its composition is,

	1.	2.	By calcu'ation.	Atoms.
Carbon	77.90	78.11	78.12	10
Hydrogen	11.57	11.38	11.49	18
Oxygen	10.53	10.51	10.38	1

represented by the formula $C^{10} H^{16} + H^2O$, or by 1 atom of dadyle and 1 water.—*Oil of cinnamon.* The distillation of the bark of the *Laurus* Cinnamonium, aided by a solution of marine salt, gave two oils, one lighter, the other heavier than water. The oil of cloves of commerce is a mixture of these two oils. It boils at 220°; at 25° C.; its sp. gr. is 1.008; treated with caustic baryta it is divided into two unequal parts; the smaller is converted into resin, and the larger forms with a base a salt soluble in water. It seems therefore to consist, like the oil of cloves, of two other oils, one acid, and the other not acid. 0.542 of this rectified oil gave 1.596 carbonic acid, and 0.375 water, in 100 parts, 81.44 carbon, 7.68 hydrogen, and 10.88 oxygen.—*Oil of juniper.* Juniper berries distilled before they are ripe, with the addition of saline water, gave two oils. Purified by washing with saline water, and by repeated distillations from lime, these oils have the common characters of being easily oxidized in the air, and of dissolving in every proportion in absolute ether; and of being but slightly soluble in alcohol of 33° B. They differ also in some characters; the first is colorless, sp. gr. 0.8392 at 25° C., boils at 155°; the solution when mixed in equal volumes with rectified alcohol is clear, but is made thick by the addition of a new quantity of alcohol: the second is colored, sp. gr. 0.8784 at 25° C., and boils at 205°. 0.349 of the first, analyzed by the oxide of copper, gave 1.116 carbonic acid, and 0.362 water. 0.551 of the second gave 1.748 carbonic acid, and 0.575 water. Their composition is therefore

	1.	2.
Carbon	88.41	87.72
Hydrogen	11.52	11.59

and seems like that of the oil of turpentine conformed to the formula $C^{10} H^{16}$.

The oil of the juniper berries when ripe and preserved does not separate into two parts; and as it possesses the properties of the second oil contained in the unripe berries, it appears to have been deprived of the first by desiccation.—*Ib.*

3. *Oil extracted from the Spirit of Wine of Potatoes* by M. J. Dumas—Ann. de. Chim. t. 56. 314.—Previous to rectification, spirit of wine, whether it be obtained from malt or potatoes, possesses a peculiar taste or smell which is removed by distillation frequently repeated. It has been long known that these properties depend on a peculiar oil, first detected by Schulec.

Fourcroy and Vauquelin proved that the oil was not a product of fermentation, but that it existed in grain and could be separated by treating it with water and taking up the oil from the liquid by alcohol. M. Payen has shown that the seat of this oil is in the tegumentary part of the fecula of potatoes. Those who have examined the oil proceeding from the spirit of barley, describe it as capable of crystalization, volatilizing with difficulty, undergoing alterations by distillation and staining paper permanently. Pelletan found on the contrary the oil from the spirit of potatoes a true essential oil. Dumas examined a specimen from the manufactory of Dubrunfaut: it possessed a reddish yellow color and a very distinguishable smell. When one breathes the air charged with it, nausea and headache are produced. Carbonate of potash diminishes the odor considerably and when distilled with it renders it analogous to that of nitric ether. In order to free it entirely from alcohol, it is necessary to distil cautiously and obtain a residue of pure oil boiling at 266°, F. or 269°, the alcohol passing over first. Dumas suggests that although bearing some affinity to alcohol and ether it may belong to the family of camphors. The density of its vapor is 3.147 or calculating from its composition 3.072. It consists of,

Carbon, - - - - - -	68.6
Hydrogen, - - - - - -	13.6
Oxygen, - - - - - -	17.8

Records of Gen. Science, No. 1, 1835.

4. *Phosphate of Lime in the teeth and Silica in the skin of the Infusoria.*—Rose of Berlin has ascertained that the hard parts which in certain tribes of infusory animals are called teeth, are composed of phosphate of lime, and that the hard case or cover with which many of these minute creatures are protected is composed of silica.—*Jameson's Ed. New Phil. Jour. April,* 1835.

GEOLOGY.

1. *On the Proofs of a gradual Rising of the Land in certain parts of Sweden. By Charles Lyell, Esq., F. R. S.*—An opinion has long been entertained that the waters of the Baltic, and even of the whole Northern Ocean, have been gradually sinking; and the purport of the present paper is, to communicate the observations which the author made during the summer of 1834, in reference to this curious question. In his way to Sweden he examined the eastern shores of the Danish islands of Moën and Seeland, but neither there, nor in Scania, could he discover any indication of a recent rising of the land; nor was there any tradition giving support to such a supposition. The first place he visted, where any elevation of land had been suspected, was Calmar; the fortress of which, built in the year 1030, appeared, on examination, to have had its foundations originally laid below the level of the sea, although they are now situated nearly two feet above the present level of the Baltic. Part of the moat on one side of the castle, which is believed to have been formerly filled with water from the sea, is now dry, and the bottom covered with green turf. At Stockholm, the author found many striking geological proofs of a change in the relative level of the sea and land, since the period when the Baltic has been inhabited by the Testacea which it now contains. A great abundance of shells of the same species were met with in strata of loam, &c., at various heights, from 30 to 90 feet above the level of the Baltic. They consist chiefly of the *Cardium edule*, the *Tellina baltica*, and the *Littorina littoreus*; together with portions of the *Mytilus edulis*, generally decomposed, but often recognisable by the violet color which they have imparted to the whole mass. In cutting a canal from Sodertelje to lake Maelar, several buried vessels were found; some apparently of great antiquity, from the circumstance of their containing no iron, the planks being fixed together by wooden nails. In another place, an anchor was dug up; as also, in one spot, some iron nails. The remains of a square wooden house were also discovered at the bottom of an excavation made for the canal, nearly at a level with the sea, but at a depth of 64 feet from the surface of the ground. An irregular ring of stones was found on the floor of this hut, having the appearance of a rude fire-place, and within it was a heap of charcoal and charred wood. On the outside of the ring was a heap of unburnt fir wood, broken up as for fuel; the dried needles of the fir

and the bark of the branches being still preserved. The whole building was eveloped in fine sand.

The author next notices several circumstances regarding buildings in Stockholm and its suburbs, from which he infers that the elevation of the land, during the last three or four centuries, has not exceeded certain narrow limits. At Upsala he met with the usual indications of a former elevation of the sea, from the presence of littoral shells of the same species as those now found in the Baltic. Certain plants as the *Glauca maritima* and the *Triglochin maritimus*, which naturally inhabit salt marshes bordering the sea, flourish in a meadow to the south of Upsala; a fact that corroborates the supposition that the whole of lake Maelar and the adjoining low lands have, at no very remote period of history, been covered with salt water.

The author examined minutely certain marks which had at different times been cut artificially in perpendicular rocks, washed by the sea, in various places; particularly near Oregrund, Gefle, Löfgrund, and Edskösund; all of which concur in showing that the level of the sea, when compared with the land, has very sensibly sunk. A similar conclusion was deduced from the observations made by the author on the opposite, or western coast of Sweden, between Uddevalale and Gottenburg; and especially from the indications presented by the islands of Orust, Gullholmen, and Marstrand.

Throughout the paper a circumstantial account is given of the geological structure and physical features of those parts of the country which the author visited: and the general result of the comparison he draws of both the eastern and western coasts and their islands, with the interior, is highly favorable to the hypothesis of a gradual rise of the land; every tract having, in its turn, been first a shoal in the sea, and then, for a time, a portion of the shore. This opinion is strongly corroborated by the testimony of the inhabitants, (pilots and fishermen more especially,) of the increased extension of the land, and the apparent sinking of the sea. The rate of elevation, however, appears to be very different in different places: no trace of such a change is found in the South of Scania. In those places where its amount was ascertained with greatest accuracy, it appears to be about three feet in a century. The phenomenon in question having excited increasing interest among the philosophers of Sweden, and especially in the mind of Professor Berzelius, it is to be hoped that the means of accurate determination will be greatly multiplied. —*Lond. and Ed. Phil. Jour., April*, 1835.

2. *Discovery of Saurian Bones in the Magnesian Conglomerate near Bristol.*—Although some of the earliest noticed Saurian remains were the fossil Monitors of Thuringia, discovered in the Continental equivalents of our magnesian limestone,—characterized by the same testacea and fishes which occur in corresponding formations in the North of England,—it does not appear that Saurian remains have been until now detected in this geological site in our own series. Recently, however a quarry of the magnesian conglomerate, resting on the highly inclined strata of carboniferous limestone, at Durham Down, near Bristol, has afforded some Saurian vertebræ, ribs, femora, and phalanges, together with claws, the latter of considerable proportional size: a coracoid bone has also been found, approaching very nearly to that of the Megalosaurus. The general character of the bones seems intermediate between those of this genus and the crocodile. Dr. Riley, who submitted the specimens hitherto discovered to the Literary and Philosophical Society of the Bristol Institution, is understood to be preparing a detailed account of this interesting discovery for the Geological Society. The only Saurian remain hitherto found in this island in a site approaching to this, was a fragment of a lower jaw apparently of a gavial discovered in the lower beds of the new red sandstone at Guy's Cliff, Warwickshire. This fact is noticed in Parkinson's small work on Organic remains.—*London and Edin. Phil. Journ.*

3. *On the Origin of the Erratic Blocks of the North of Germany.*—The following conclusions are given as the result of Klöden's investigations on this subject; they form the concluding paragraph in his interesting work, entitled,“ *The Petrifactions of Brandenburg, especially those which occur in the rolled Stones and Blocks of the South Baltic Plain.*” 1. A part of the erratic blocks of the plain of North Germany, and indeed, by much the larger portion, have a great analogy to the rocks of the north of Europe, and those rolled masses which contain petrifactions, also agree in their organic remains with northern rocks; and indeed, there are even rocks and petrifactions among them which are peculiar to the Scandinavian peninsula. On the other hand, many of the rocks and petrifactions which are characteristic of the north, have not been found among the rolled masses, and those petrifactions which are extremely abundant in Norway and Sweden, are replaced by others in the erratic blocks. 2. Another part of the rocks containing petrifactions, which occur as blocks,

agree in external characters with the rocks of the north, but contain petrifactions which have not yet been found in Scandinavia. Many of these petrifactions are amongst the most abundant which occur in the blocks. 3. A third class belong to rocks which are entirely wanting in the north, and the petrifactions which some of them contain are never met with in Norway or Sweden. 4. The first only of those divisions of rocks can, with probability, have a northern origin assigned them; in regard to the second it is more doubtful; but we cannot admit such a view in regard to the third class, and that which is the richest in petrifactions. 5. The last cannot with probability be asserted to have been derived from the mountains which bound the South Baltic Plain. 6. Nor can they have come from mountain masses destroyed in their original situation. 7. They cannot be supposed to have at an earlier period existed in the north, unless we assume what is very improbable. Thus it appears that the result of my labors in regard to answering the question of the native country of the erratic block is almost a negative one. It is doubtful if a more intimate acquaintance with these masses will lead more speedily to the answer to this question than a fortunate hypothesis. It is certain, however, that complete investigations on the nature of erratic blocks will afford a secure basis for inquiries as to their origin, and it is therefore to be wished that we should receive numerous and accurate contributions to our knowledge of the blocks of all parts of the South Baltic Plain. So much, however, is decidedly proved by my labors, that the great geognostical phenomena of the erratic blocks in the South Baltic Plain, cannot be explained by one simple event, and that much more complicated causes and forces must have co-operated than has hitherto been believed. It is equally evident that we stand at a greater distance from the solution of the problem than we imagined; that apparently the key to the great riddle is not yet found, and that the question seems now less satisfactorily determined than ever.—*Jameson's Ed. New Phil. Jour., April,* 1835.

4. *Analysis of the Fossil Tree seen at present imbeded in the Sandstone at Craigleith Quarry, by Mr. Robert Walker.*—Exposed to heat in a tube, it gives off bituminous matter and water, and dissolves with considerable effervescence in diluted muriatic acid, carbonaceous matter being at the same time deposited. Its constituents are, carbonate of lime, 50.36; carbonate of iron, 24.65; carbonate of magnesia, 17.71; coal, with silica and water 6.15;=98.87.—*Ib.*

5. *Wollaston Medal.*—The Wollaston Gold Medal has been awarded by the Geological Society to Dr. Mantell of Brighton, for his many important discoveries in Fossil Comparative Anatomy, particularly of the genera *Iguanodon* and *Hylæosaurus.*—*Ib.*

The grounds of this justly merited award were eloquently displayed, in an address of Charles Lyell, Esq., the new president of the Geological Society, and we have great pleasure in adding these remarks, as they give a spirited outline of one of the most extraordinary and successful geological developements which has ever been made.—*Am. Ed.*

"I have now to discharge the agreeable duty of proposing the health of a distinguished member of this Society, to whom the Council have this day awarded the Wollaston medal. Gentlemen, I have to propose the health of Dr. Mantell. (Loud cheers.) It was a great disappointment to me when I received a letter from my friend, requesting me to attend at your meeting this morning, and to receive the medal, for him. He stated that he should be unable to receive it in person, being prevented from coming here, and from meeting us at this dinner, partly by indisposition, but still more for reasons which we can none of us regret, a press of professional business at Brighton. I know that there are many gentlemen now present, who had not the advantage of hearing in the address delivered this morning by Mr. Greenough, the announcement of the specific grounds of the award made by your council, and I shall therefore state that the medal was conferred on Dr. Mantell for his discoveries in fossil Comparative Anatomy, particularly of the genera Iguanodon and Hylæosaurus. There are few of you I presume wholly unacquainted with the results of some of Dr. Mantell's labors in this department of science—few who have not either read of them in his works, or seen them in his splendid museum. That collection, now at Brighton, which has been visited, I believe I may say without exaggeration, by thousands of persons, is of itself a monument of original research and talent, well deserving, even if he had never written on the subject, as high a mark of distinction as the Society has conferred upon Dr. Mantell this day. It is an assemblage of treasures which the mere industry of a collector could never have brought together, and which wealth alone, even had Dr. Mantell possessed it, could never have purchased. It required his zeal, inspired by genius, and directed by science, to bring to light, and as it were call into

existence so many monuments of the former state of the animate creation. Gentlemen, you will, I am sure, allow me to dwell somewhat at length on this topic, as one which is to me of no ordinary interest, for it is now nearly twenty years since I first had the good fortune to become acquainted with Dr. Mantell—before I had the honor of knowing any one of the leading members of this society—before indeed I had heard of the existence of the society itself. At that time the collection at Lewes was in its infancy, yet contained some osteological remains of that class, for the illustration of which it has since become so celebrated. Even at that time my friend had indulged sanguine anticipations from seeing a few fragments only of those bones, of the splendid discoveries which he should make in regard to these gigantic saurians—even then he foresaw some of the results which have since been realized. I had afterwards many opportunities of revisiting Lewes, more than once in company with Dr. Buckland, and after each interval found Dr. Mantell's museum enriched with new fossils, some of his former theories and conjectures confirmed, and new views opening upon his mind. As your late President (Mr. Greenough) did not dwell in his address this morning on the circumstances of peculiar difficulty under which some of these anatomical researches were carried on—difficulties which would have discouraged one of a less enthusiastic and sanguine temperament than Dr. Mantell, I will endeavor to point them out to you. A geologist who explores the wealds of Kent and Sussex, never meets with entire skeletons, as at Lyme Regis or at Whitby, or even small portions of a skeleton connected together. He must patiently wait and gather a multitude of detached and disconnected bones; almost every tooth, every rib, every vertebra, must be taken from a different place: and as if to make the task still more perplexing, the relics of a variety of large species of saurians are promiscuously mingled together, and scattered as it were at random through the rocks. I believe that the skeletons in the ancient estuary were rolled backwards and forwards by the tides, till scarcely any two bones remained together: to reunite these into a whole, to refer to each skeleton the parts which once belonged to it, and not to confound the different species together, was a task demanding no common degree of skill, reflection and judgment, and an intimate knowledge of the laws governing the analogies of structure, and the relations of the different genera of vertebrated animals.

"It was from these scattered elements that the skeletons of these gigantic reptiles of the Weald were constructed, with which we seem now so well acquainted—those huge saurians, some individuals of which this room could scarcely contain, concerning whose osteological structure and former habits, we can now reason with confidence, and which obtain as real an existence in our imaginations as if they were living this moment in the waters of the Ganges or the Nile. Mr. Greenough has pointed out to you how strikingly some discoveries lately made of an assemblage of the bones of the Iguanodon grouped together in one mass of rock, have shewn the sagacity with which Mr. Mantell had put together the disconnected remains which were first discovered. All the bones thus met with in one block were such as he had previously considered as belonging to the Iguanodon with no intermixture of those which he had rejected as probably referable to other saurians. And here I may notice when speaking of the Iguanodon, that there is a peculiar propriety in your awarding the Wollaston medal to the discoverer of the genus, since I well remember the evening at the Geological Society, when Dr. Wollaston having seen the first tooth exhibited by Dr. Mantell in London, warmly encouraged him to pursue his researches, and that too, when, as Dr. M. thought, others were less struck, and less interested with the subject. But gentlemen, I must trespass no longer on your indulgence, and will only remark, that if the exertions of my friend would have called for our grateful acknowledgments under any circumstances, how much more so are they entitled to our praise and admiration when we recollect the peculiar difficulties under which he has followed up his scientific investigations. His hours of study have been confined to those moments which could be spared from the labors of a profession to which he has devoted the principal energies of his mind, and I rejoice to say with great and uniform success. There have always been some men in the medical profession who have combined extensive practice at the same time that they have enlarged the boundaries of some collateral science, and it gives me great pleasure to declare that Dr. Mantell's name will be added to that honorable list, and that after but a years residence at Brighton, his rapidly increasing practice proves that his triumphant success is certain. His health is now the only subject of our anxiety, and that I trust will be soon restored: Gentlemen, I have again to propose the health of Dr. Mantell, the Wollaston medallist. (Loud and continued cheering.)"

MINERALOGY.

1. *Triphylme, a new mineral.*—Professor Fuchs, of Munich, has discovered in Bodenmais, Bavaria, and described under the name of Triphylme, a new mineral, which consists of the Phosphates of iron, manganese and lithia.—*L'Institute, March* 11, 1835.

2. *Hydroboracite, a new mineral.*—Colour white, radiated and foliated, and soft like gypsum. Specific gravity=1.9. It is readily distinguished from such minerals as it might be confounded with, by its easy fusibility before the blow pipe. According to H. Hess, it contains the following ingredients; Lime 13.298, magnesia 10.430, water 26.330, boracic acid 49.922; =100.00.—*Jameson's Ed. New Phil. Jour. April,* 1835.

3. *Diamonds at Algiers.*—The Sardinian consul at Algiers, M. Peluzo, lately purchased from a native three diamonds, which were found in the auriferous sand of the river Gumel, in the province of Constantine. One of them was purchased by M. Dufresnoy, the other two by M. Brongniart, for the museum and collection of M. de Dreé.—*Ib.*

4. *Allanite of Greenland.*—This rare mineral occurs imbedded in the granite of Greenland, where it was discovered by the late Sir Charles Giesecke. Mr. Allan conjectured it might be a variety of gadolinite, but Dr. Thomson of Glasgow, who was furnished with specimens for examination by Mr. Allan, determined that, chemically considered, it must be owned as a new species, which he named Allanite, in honor of Mr. Allan. Thomson found it to contain, of silica 35.1, oxide of cerium 33.9, black oxide of iron 25.1, lime 9.2, alumina 4.1, volatile substances 4.0, =112.0. The imperfection of this analysis, shewn by the excess of the constituent parts, rendered a repetition of it desirable. Fortunately the Allanite has been again analyzed by the celebrated Stromeyer, who gives the following as the result of his analysis: Silica 33.021, alumina 15.226, protoxide of cerium 21.600, protoxide of iron 15.101, protoxide of manganese 0.404, lime 11.080, and water 3.000;=99.432. It follows from this analysis, that the Allanite, although in composition nearly allied to the orthite of Berzelius, differs from it in not containing yttria. It is still uncertain if the Cerin of Haidinger is the same mineral as Allanite; and it is equally doubtful if the mineral from the Mysore, analyzed by Wollaston, belongs to the Allanite species.—*Ib.*

5. *Needle Ore.*—This was first analyzed by John, who proved that it was not, as had been previously supposed, an ore of chrome, but a combination chiefly of bismuth, lead, copper, and sulphur, in which the proportions were as follows; Bismuth 43.20, lead 24.32, copper 12.10, *nickel* 1.58, *tellurium* 1.32, sulphur 11.58, loss 5.90;=100.00. In a late analysis of this ore by Hermann Frick, in Poggendorf's Annalen for 1834, the nickel and tellurium (which, by the by, John had placed as conjectural substances) were not found. After repeated analyses, he gives the following as the composition of this ore: Sulphur 16.61, bismuth 36.45, lead 36.05, copper 10.59, ;=99.70. The formula of composition, $\dot{C}op\dot{B}i+2\dot{P}b\dot{B}i$. —*Ib.*

6. *Platina and Gold of the Uralian Mountains.*—It would appear, from some late investigations, that the platina occurs in disseminated grains and also in masses of several pounds weight, in serpentine in which it is associated with chromate of iron. Part of the gold of that region occurs in quartz veins, along with auriferous iron-pyrites, and grains of gold have also been detected in the serpentine. The chlorite slate of the Urals probably also contains platina.—*Ib.*

7. *Idocrase in the Isle of Skye. Discovered by G. B. Greenough, Esq.*—This mineral was found at the junction of a trap dike with the calcareous rock it traverses. Its locality is about a mile and a half south of Broadford, on the way to Kilbride. The dike averages about four yards in width. Mr. Greenough could not determine its extent, from the heather, &c. which covers the surface.—*Ib.*

8. *Chiastolite.*—According to Dr. G. Landgrebe of Marbourg, as stated in Schweigger-Seidel's Journal, H. 5, 1830, this mineral contains, silica 68.497, alumina 30.109, magnesia 1.125, water and carbon 0.269;=100.00. The remarkable structure of this mineral is well known; we may add, from Weiss, that many salts, as muriate of soda for example, when dissolved in fatty substances, as butter, and again crystallized from them, exhibit in their crystals the same structure as observed in chiastolite.—*Ib.*

9. *Antimonial Nickel.*—Our latest discovery from the ever inexhaustible Andreasberg is a very interesting mineral, a combination of nickel and antimony, resembling at first sight coppernickel; but having attracted the attention of a pupil of mine, Mr. Charles Volkmar

of Brunswick, Stromeyer and self followed up the examination. The ore is found in minute thin hexagonal plates, which seem to be regular, and in interspersed particles, on galena and speiscobalt. Fracture uneven, passing into small conchoidal. The terminal planes are of a high metallic lustre, the planes of fracture shining. The color is a light copper-red, with a strong inclination to violet. This bluish exterior resembles certain variegated colors, but the character is the same in its fresh fracture. The powder is reddish-brown. The ore is brittle. Its hardness rather that of copper-nickel, being scratched by felspar, but scratches fluor. The specific gravity cannot as yet be ascertained, on account of the smallness of the specimens. Stromeyer's analysis is, nickel 31.207, antimony 68.793 ;= 100. We gave it the name of Antimonial Nickel (Antimon. Nickel).—*Hausman.*—*Ib.*

10. *Account of Artificial Felspar, by Professor Kersten.*—Professor Kersten, as appears from a number of Poggendorf's Annalen, No. 22. for 1834, has found distinctly formed crystals of prismatic felspar on the walls of a furnace, in which copper slate and copper ores were melted. Among these *pyro-chemically* formed crystals, some were simple, others twin. The surface of the crystals was smooth or vertically streaked ; fracture conchoidal. Lustre of the crystals vitreous, and color rose red, passing into violet blue. Are opaque, brittle, and hardness=6 of Mohs' scale. Chemical trials proved that they are composed of silica, alumina, and potash, consequently the same constituents as felspar. As accidental parts, traces of manganese and lime may be mentioned. Mitscherlich, who examined these artificial felspar crystals, says, they exhibited the primitive planes of the oblique prism, and were truncated on the acuter lateral edges ; a distinct cleavage was observed parallel with the truncating and terminal planes, which meet under an angle of 90°. Hitherto every attempt to make felspar crystals by artificial means has failed ; hence, in a geological point of view, this fact of Kersten's is of very great importance.—*Ib.*

11. *Crystals of Oxide of Chrome.*—Professor Wöhler has prepared beautiful crystals of this mineral. These crystals were both single and twin, belonging to the same rhomboidal series as corundum. One of the most interesting features in these crystals is their great hardness, it being equal to that of corundum.—*Ib.*

PHYSICS.

1. *New Thermoelectric piles of Nobili.*—The first of these, named *pile a rayons*, consists of a certain number of thermoelectric pairs of antimony and bismuth, disposed in rays around a common centre, and in the same plane. Each of the pairs terminates by a very fine point directed towards the center of the system, but sufficiently distant to isolate the plates. The communications of one pair with another are established in the circumference by small arcs of bismuth or antimony soldered to convenient points, taking care so to complete the circuit, that the two elements, one of bismuth, and the other of antimony, remain free, and form the two poles destined to receive the wires of the galvanometer. This assemblage is attached to a thin wooden disc, open in the middle, displaying the points, and the whole contained in a circular brass box, in two parts, also pierced in the center. In one of these last openings is adapted, in the direction of the axis, a brass tube closed at top except a small hole in the center, through which can be seen the center of the pile. This hole should be so small as to prevent the heat of the eye from acting on the pile, and may be closed with a thin plate of mica or gypsum. The box has a vice on its side to attach it to any support. To govern the access of the heat to the thermo-electric points, a movable sector, pierced with several groups of small holes of different diameters is attached to the central opening in the bottom of the box.

The advantages of this pile over others, are, greater intensity, the number of elements being equal, feels the influence of caloric, and returns to its previous temperature more rapidly; through the central openings may be seen the luminous effect when accompanied by a calorific effect; and it is adapted peculiarly, besides all ordinary uses, to researches whose object is the concentration of calorific rays.

Some experiments made with this instrument.—1. M. Nobili finds that radiant heat is not polarized in traversing the tourmaline, nor by reflexion, nor upon ordinary polarizing surfaces, nor upon metallic surfaces. 2. He caused the rays from a cube of hot iron (not red) to traverse a lens of rock salt, and concentrated them into a focus, as luminous rays. 3. He substituted for the iron, the flame of an argand lamp, and placed before the opening of the pile a small metallic obstacle just large enough to intercept the luminous rays, and ob-

tained then a slight deviation of the needle which was due to the calorific rays, which being less refrangible than the luminous rays, pass by the side of the obstacle.—*L'Institut, Mars*, 1835.

ASTRONOMY.

1. *Comet of Biela.*—Prof. Santini, of Padua, who has been much occupied with this comet, has made many researches to determine exactly the orbits of 1826 and 1832, and to assign according to all the observations of 1832, and considering the perturbations, the new elements for 1839. These new elements are accompanied with an ephemeris, comprising thirty-five positions of the comet, with its logarithmic distance from the earth and from the sun, every four days from the 20th March to the 3d of October.

Elliptical elements of the periodical Comet of Biela, having regard to the planetary perturbations, without taking into account the resistance of the ether.

	1826.	1832.	1839.
Passage to the perihelion—mean time at Padua	77d.445152	331d.153170	204d.03907
Longitude of perihelion	109°45′59″53	110°00′55″05	110°06′16″33
" " node	251 28 31 69	248 15 36 09	248 13 18 59
Inclination upon the ecliptic	13 33 51 09	13 13 00 92	13 12 24 49
Angle of the eccentricity	48 17 39 70	48 42 34 96	48 43 16 80
Logar. of the semi-diameter of the larger axis	0.5516037	0.5483436	0.5483436
Mean sidereal diurnal motion	527″9599	533″736084	533″938407
Longitude referred to the mean equinoxe	9. Mar. 1832.	0. Jan. 1833.	23. July 1839.

L'Institut, Mars, 1835.

MISCELLANEOUS.

1. *Introduction of Frogs into Ireland.*—It is not generally known that the introduction of frogs into Ireland is of comparatively recent date. In the seventeenth number of the Dublin University Magazine, there is a quotation from the writings of Donat, who was himself an Irishman, and bishop of Fesulæ, near Florence, and who, about the year 820, wrote a brief description of Ireland, in which the following passage occurs:

> "Nulla venena nocent, nec serpens serpit in herba;
> Nec conquesta canit garrula rana lacus"

"At this very hour," says our respected contemporary, "we have neither snakes nor venomous reptiles in this island; and we know, that, for the first time, *frog-spawn* was brought from England in the year 1696 by one of the Fellows of Trinity College, Dublin, and placed in a ditch in the University park or pleasure-ground, from

which these very prolific colonists sent out their croaking detachments through the adjacent country, whose progeny spread from field to field through the whole kingdom. No statue has yet been erected to the memory of the natural philosopher who enriched our island with so very valuable an importation of melodious and beautiful creatures." We may state, however, that we have learned from good authority, that a recent importation of snakes has been made, and that they are at present multiplying rapidly within a few miles of the tomb of St. Patrick.—*Dublin Med. and Chem. Journal*, vol.v. No. xv. p. 481.

2. *On the Rapidity of Vegetable Organization.*—The vegetable kingdom presents us with innumerable instances, not only of the extraordinary divisibility of matter, but of its activity in the almost incredible rapid development of cellular structure in certain plants. Thus, the *Bovista giganteum* (a species of fungus) has been known to acquire the size of a gourd in one night. Now, supposing with Professor Lindley, that the cellules of this plant are not less than the $\frac{1}{200}$th of an inch in diameter, a plant of the above size will contain no less than 47,000,000,000 cellules; so that, supposing it to have grown in the course of twelve hours, its cellules must have been developed at the rate of nearly 4,000,000,000 per hour, or of more than 96,000,000 in a minute!* and, when we consider that every one of these cellules must be composed of innumerable molecules, each of which is composed of others, we are perfectly overwhelmed with the minuteness and number of the parts employed in this single production of nature.

3. *How to make Eatable Food from Wood.*†—To make wood-flour in perfection, according to Professor Autenrieth, the wood, after being thoroughly stripped of its bark, is to be sawed transversely into disks of about an inch in diameter. The saw-dust is to be preserved, and the disks are to be beaten to fibres in a pounding-mill. The fibres and saw-dust, mixed together, are next to be deprived of every thing harsh and bitter which is soluble in water, by boiling them, where fuel is abundant, or by subjecting them for a

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* Introd. to Bot. p. 7.

† In a former number of this Journal we gave some details in regard to bread made from wood and from bark.

longer time to the action of cold water, which is easily done by enclosing them in a strong sack, which they only half fill, and beating the sack with a stick, or treading it with the feet in a rivulet. The whole is then to be completely dried in the sun, or by fire, and repeatedly ground in a flour-mill. The ground wood is next baked into small flat cakes, with water, rendered slightly mucilaginous by the addition of some decoction of linseed, mallow stalks and leaves, lime-tree bark, or any other such substance. Professor Autenrieth prefers marsh-mallow roots, of which one ounce renders eighteen quarts of water sufficiently mucilaginous, and these serve to form four pounds and a half of wood-flour into cakes. These cakes are baked until they are brown on the surface. After this, they are broken to pieces, and again ground, until the flour will pass through a fine bolting cloth, and upon the fineness of the flour does its fitness to make bread depend. The flour of a *hard wood* such as beech, requires the process of baking and grinding to be repeated. Wood-flour does not ferment so readily as wheaten-flour; but the Professor found fifteen pounds of birch-wood flour, with three pounds of sour wheat-leaven, and two pounds of wheat-flour, mixed up with eight measures of new milk, yielded thirty-six pounds of *very good bread*. The learned Professor tried the nutritious properties of wood-flour, in the first instance, upon a young dog; afterwards he fed two pigs upon it; and then, taking courage from the success of the experiment, he attacked it himself. His family party, he says, ate it in the form of gruel or soup, dumplings and pancakes, all made with as little of any other ingredient as possible: and found them palatable, and quite wholesome. Are we, then, instead of looking upon a human being stretched upon a bare plank, as the picture of extreme want and wretchedness, to regard him as reposing in the lap of abundance, and consider henceforth, the common phrase, "bed and board," as compounded of synonymous terms?—*Quarterly Review, November*, 1834.

For Sale—*The Cabinet of Minerals of the late Dr. Young, of Edenville, New York.*—This collection was selected with great care, by Dr. Young, and embraces the rare and beautiful productions of Orange County, N. Y. and Sussex Co. N. J. Its crystals of Spinelle, Corundum, Franklinite, Brucite, Troostite, Melanite, Hornblende, Bronzite, Idocrase, &c. would be an invaluable acquisition to any public cabinet; it has been generally pronounced by mineralogists to be one of the most select and beautiful collections, ever formed in this country.

Fig. 2.

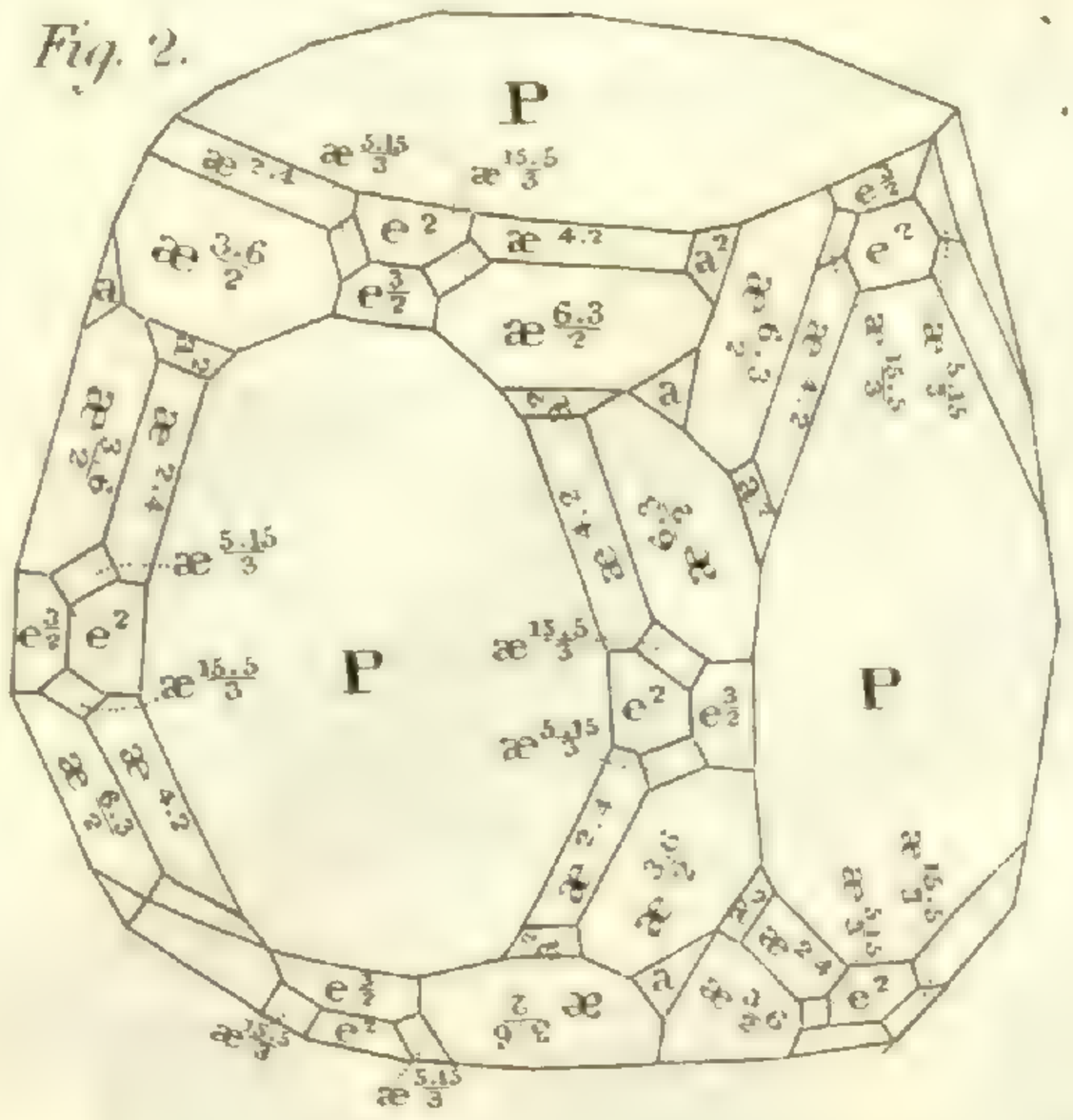


Fig. 3.

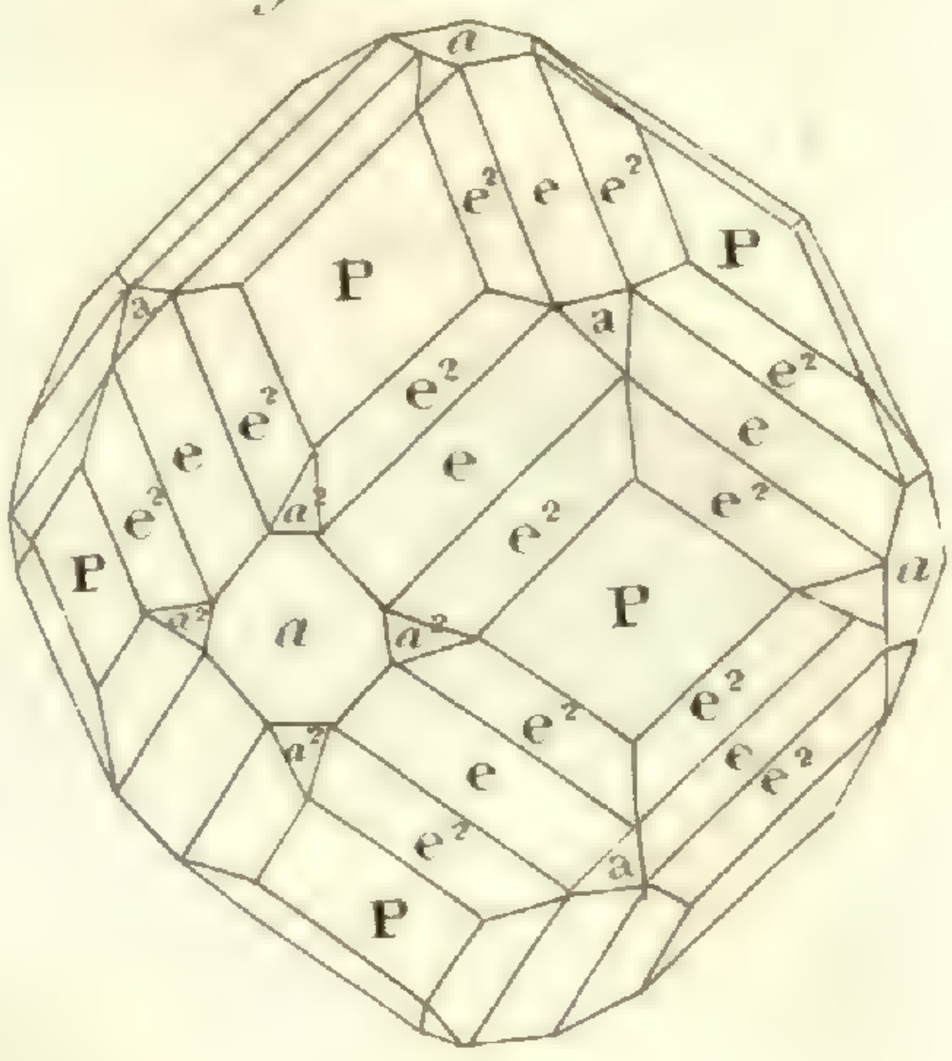


Fig. 4.

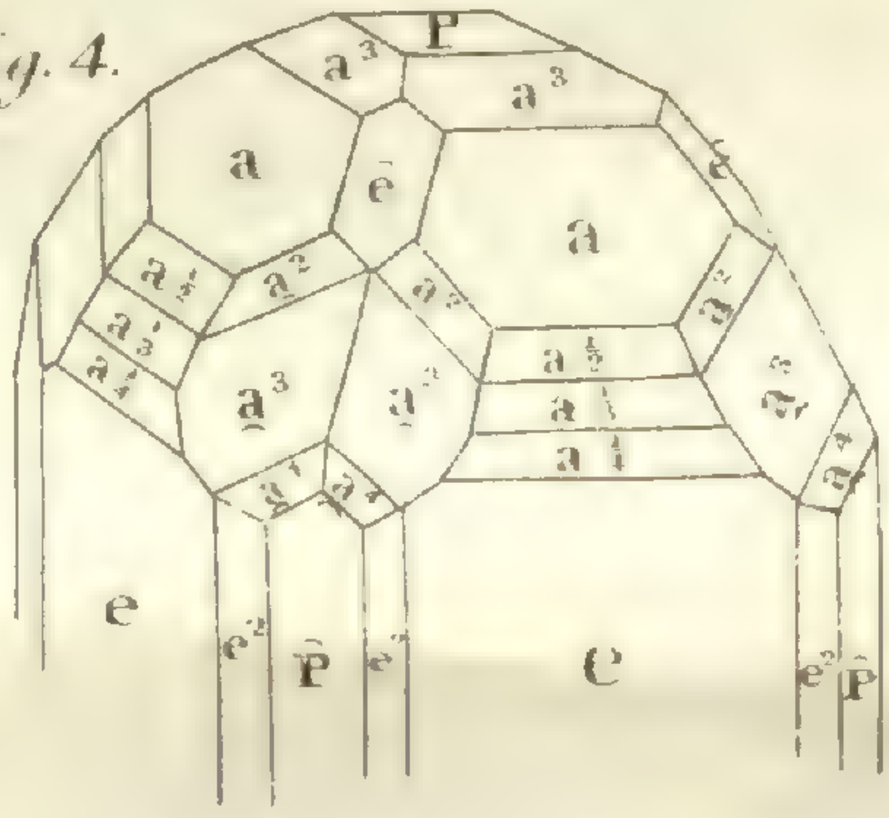
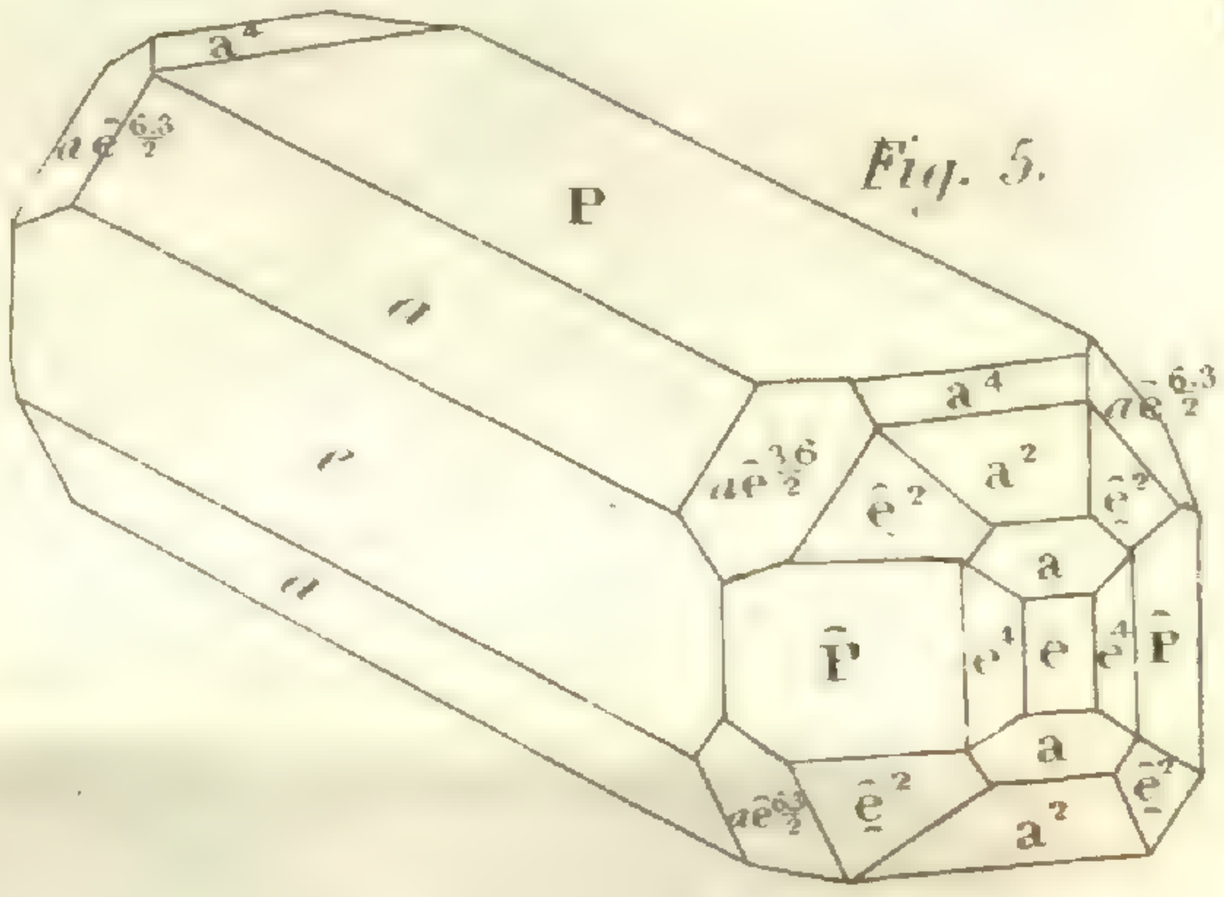


Fig. 5.



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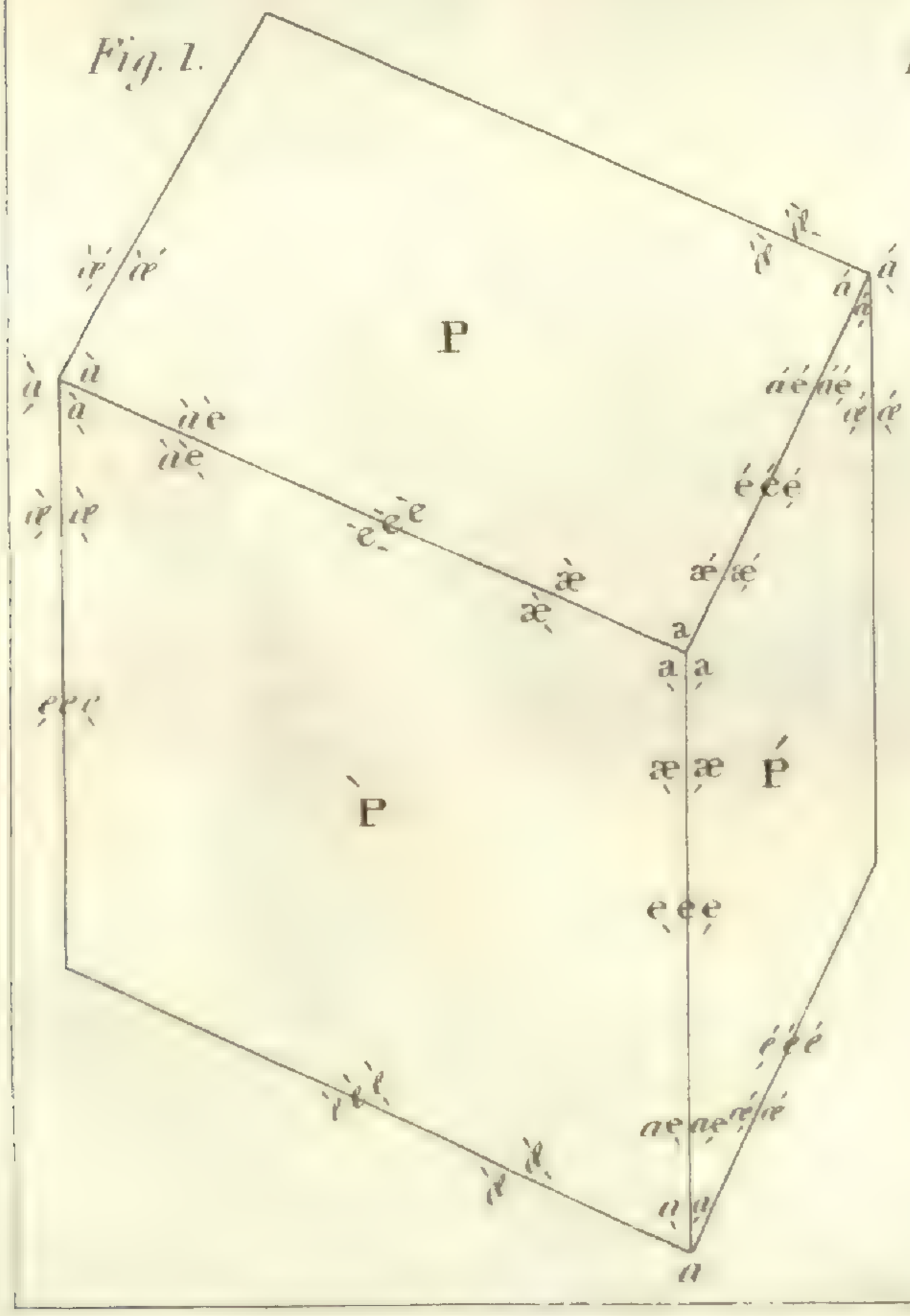
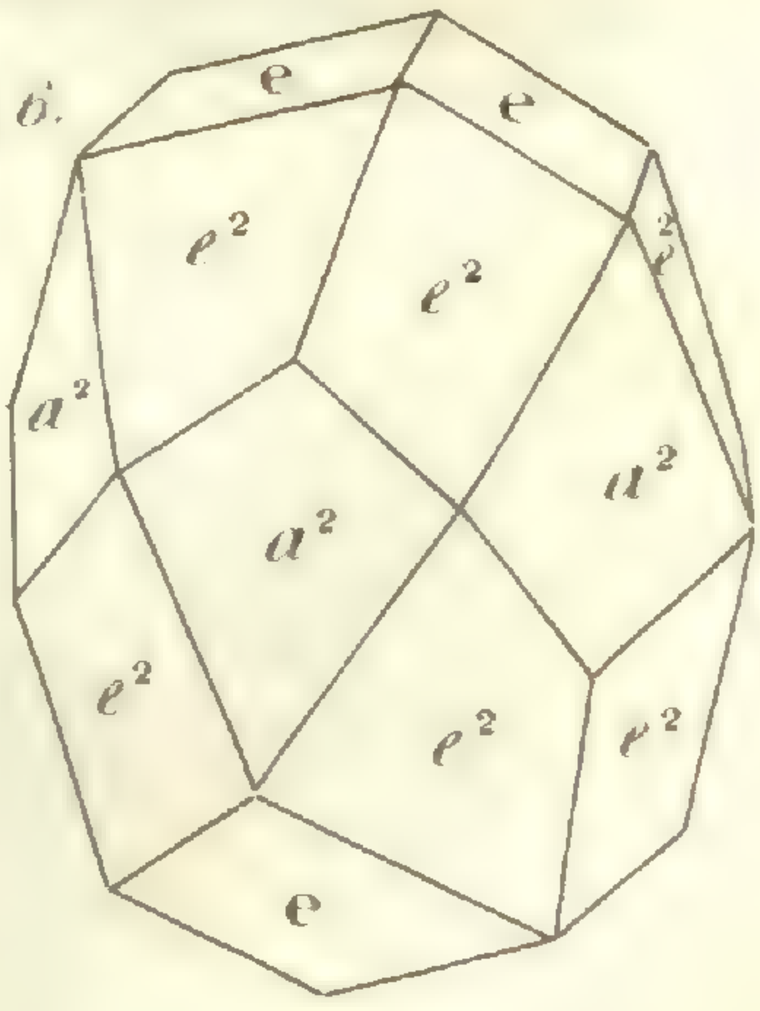


Fig. 6.



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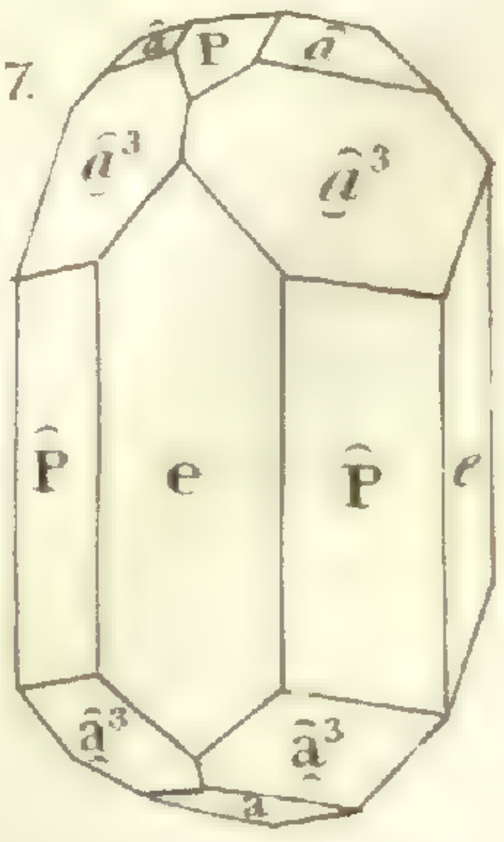
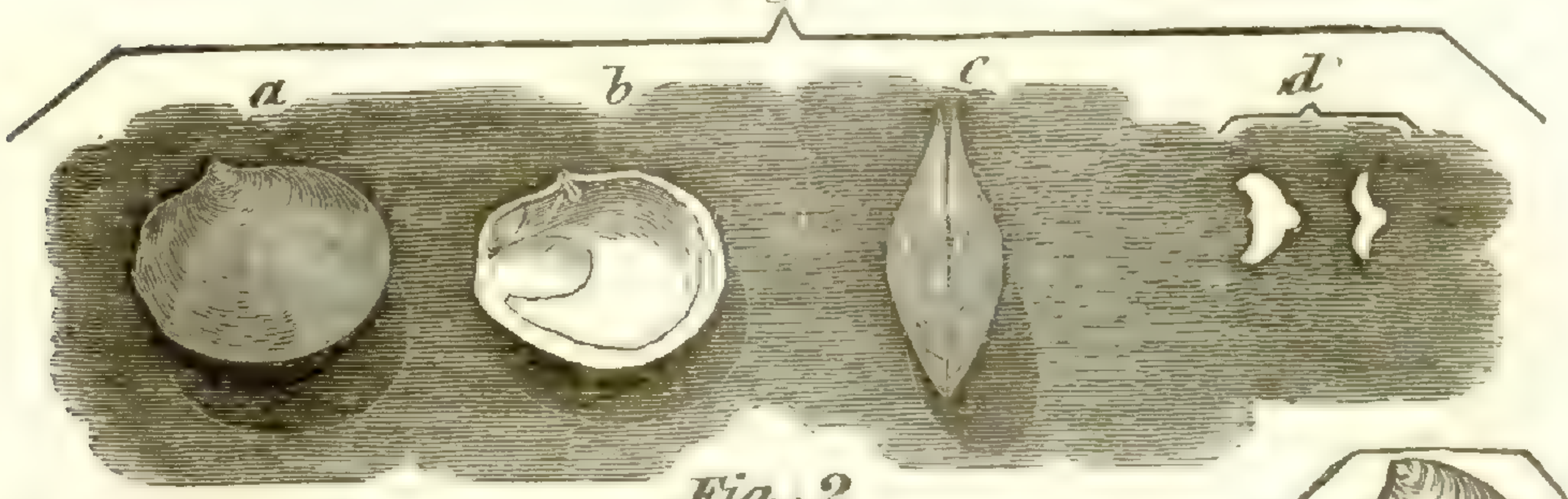


FIGURES OF CRYSTALS.

Shells belonging to the Coast of New England.—See p. 347.

Fig. 1.



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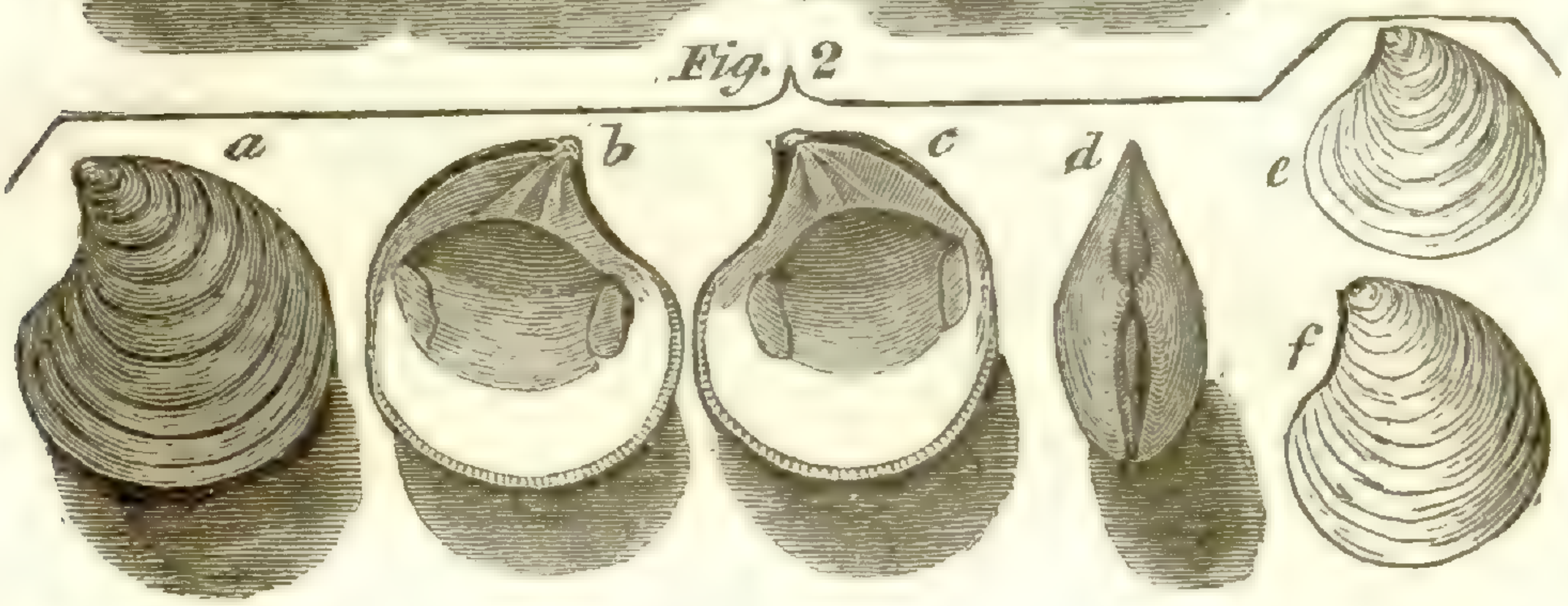

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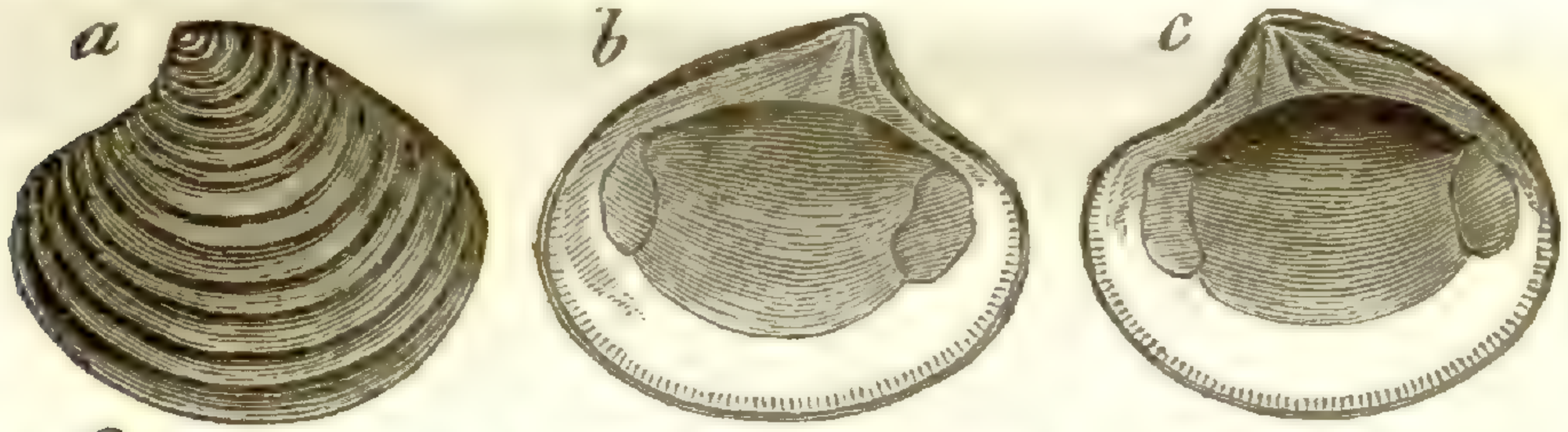

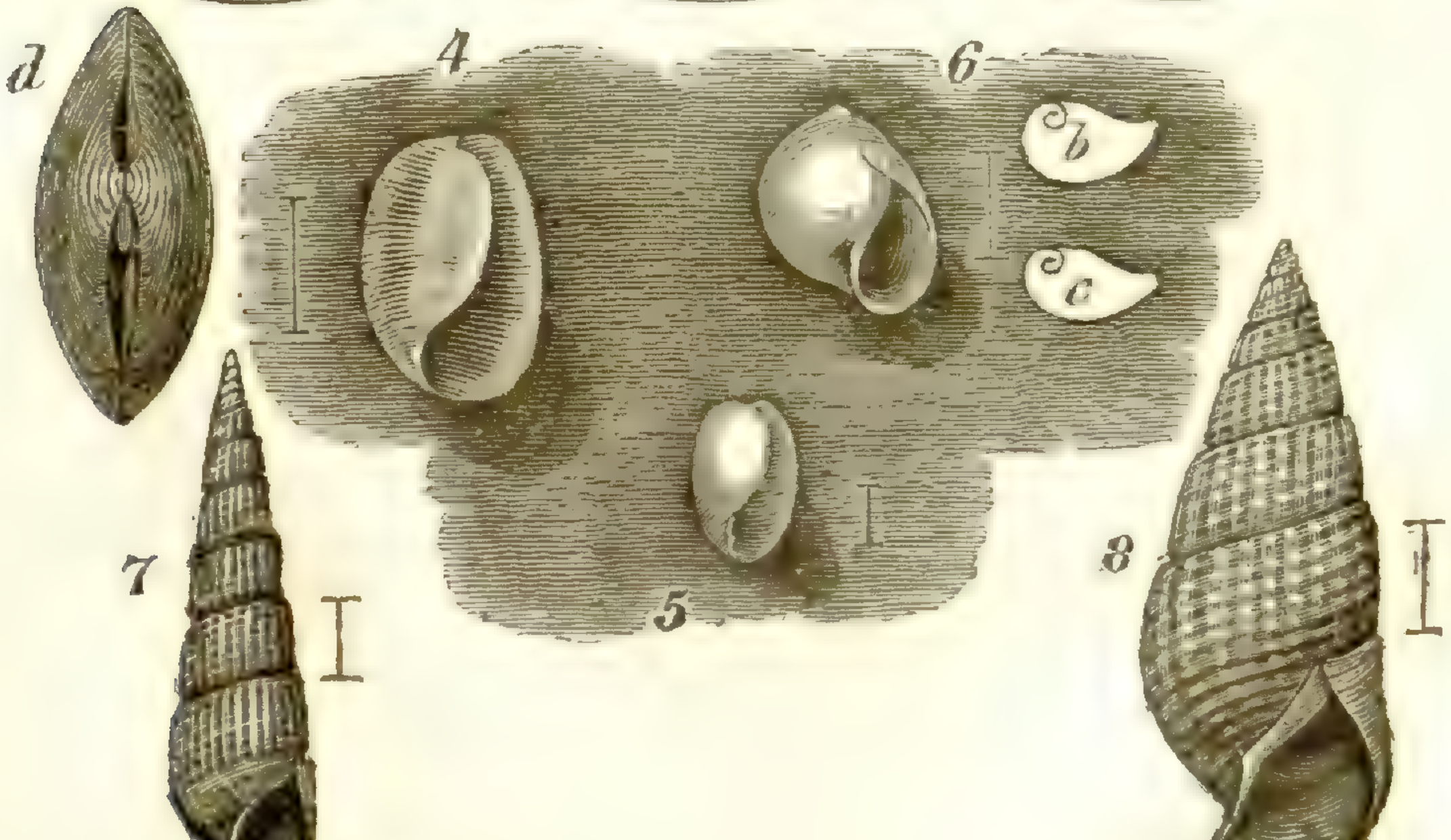

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